AgRISTARS

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A Joint Program for Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing

July 1981

Foreign Commodity Production Forecasting

COUNTRY SUMMARY REPORT - AUSTRALIA

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16. Abstract

Australia is one of the world's major growers and exporters of wheat and as such is one of the countries of interest in the AgRISTARS program which endeavors to develop technology to estimate crop production using aerospace remote sensing. This report is a compilation of geographic, political, and agricultural information on Australia. Also included in this report is a summary of the aerospace remote sensing, meteorological, and ground-observed data which have been collected with respect to Australia, as well as a summary of contacts between AgRISTARS and Australia personnel.

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COUNTRY SUMMARY REPORT - AUSTRALIA

Job Order 72-231

This report describes evaluation and analysis activities of the Foreign Commodity Production Forecasting project of the AgRISTARS program.

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Under Contract NAS 9-15800

For

Earth Resources Applications Division

Space and Life Sciences Directorate

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LYNDON B. JOHNSON SPACE CENTER
HOUSTON, TEXAS

July 1981

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PREFACE

The Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing is an 8-year program of research, development, evaluation, and application of aerospace remote sensing for agricultural resources, which began in fiscal year 1980. This program is a cooperative effort of the National Aeronautics and Space Administration, the U.S. Agency for International Development, and the U.S. Departments of Agriculture, Commerce, and the Interior.

The work which is the subject of this document was performed within the Earth Resources Applications Division, Space and Life Sciences Directorate, at the Lyndon B. Johnson Space Center, National Aeronautics and Space Administration. Under Contract NAS 9-15800, personnel of Lockheed Engineering and Management Services Company, Inc., performed the tasks which contributed to the completion of this research.

FOREWORD

This country report is a compilation of geographic, political, and agricultural information from a variety of sources. Much of the geographic and political information was taken directly from Australia Handbook 1975 by the Australian Information Service, and Official Year Book, New South Wales No. 65, 1979. This report is meant to be a concise document of available information acquired as of this date on Australia.

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1. INTRODUCTION

1.1 LOCATION OF AUSTRALIA (FIGURE 1)

Australia is an island continent bounded on the west by the Indian Ocean and on the east by the Coral Sea and the Tasman Sea of the South Pacific Ocean. It compares to the United States as follows.

AUSTRALIA

Between east longitudes 113 degrees 9 minutes (E113^{o}09') and 153 degrees 39 minutes (E153^{o}39') and between south latitudes 10 degrees 41 minutes (S10^{o}41') and 43 degrees 39 minutes (S43^{o}39').

UNITED STATES (Continental U.S.)

Between west longitudes 68 degrees (W68^{o}) and 125 degrees (W125^{o}) and between north latitudes 25 degrees (N25^{o}) and 48 degrees (N48^{o}).

1.2 HISTORY

Australia is thought to have been inhabited for 30,000 years; however, it was not until the late 1600's that European explorers visited Australia. More than 70 years after that, in 1770, Captain James Cook formally took possession of the eastern parts of the continent.

Initially, England made no attempt to colonize, but in 1788 with the loss of the American colonies (the War of Independence) together with the need for alternative overseas settlement for lawbreakers sentenced to deportation, the first small convict settlement started near what is Sydney today. At that same time, possession was taken of the whole eastern part of the continent, including Tasmania, as far westward as the 135th degree of longitude (present day South Australia). Gradually the land around the settlement was brought under cultivation. Soils for the most part were poor and crop yields low, but better agricultural land was soon found in the west near Paramatta (New South Wales). For many years, the Blue Mountains were an impassible barrier to the westward expansion of settlement.

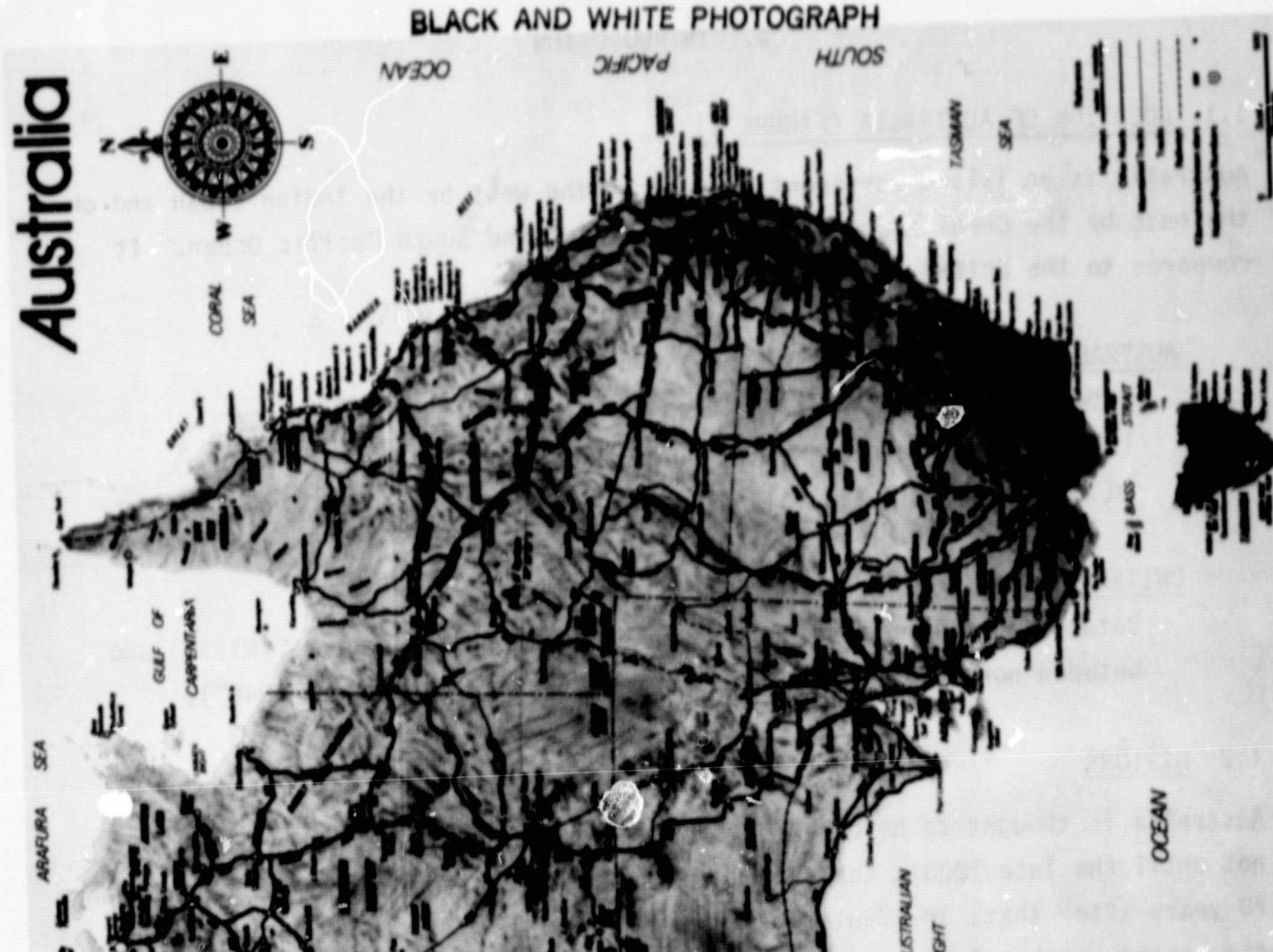

Figure 1.- The Continent, Australia. (Source: Australia Tourist Commission.)

In 1813, a way over the mountains was found and westward migration began. Early governors had the power to make free grants of land to anyone willing to employ convicts and take over feeding and clothing them. With the rapid growth of the free population and an even greater increase in livestock numbers, settlement of the new land spread quickly; and, with the discovery of a way through the Blue Mountains, expansion to the west became possible.

Experiments in sheep breeding around 1800 led to development of the wool industry. Meanwhile, immigration and the natural increase in the free population along with public agitation concerning convicts led to the end of transportation of convicts to New South Wales. Later it also ended in Tasmania, Western Australia, and other colonies.

Australia's land settlement resembled in some ways settlement in the American west. Individuals carved out large pastoral holdings beyond the crown lines. Since these holdings were on crown land, the people were squatters. The squatter class, as a large land holding class, survived.

1.3 GOVERNMENT--THE COMMONWEALTH OF AUSTRALIA (REFER TO APPENDIX A)

The present Australian Capital Territory was ceded from New South Wales to become federal territory in 1911. The capital city-to-be was named Canberra in 1913. The first Federal Parliament to meet in Canberra was opened by the Duke of York (later King George VI) in May 1927.

The government is based on a three-tier system, as follows.

1. Australian Parliament (the legislature)

   The Australian Parliament has powers laid down in the written constitution which can be changed only by referendum and then only if a majority of voters in at least four of the six states, as well as an overall majority, favor it.

   Responsible for:

   1. foreign affairs
   2. defense
   3. immigration
   4. customs and excise duties
   5. external trade and commerce

6. communications
7. coinage
8. banking
9. most territories
10. social services
11. industrial arbitration beyond the states
12. income taxes
13. funds to the states

2. Six state governments and their legislatures

The six state governments have responsibilities within their own boundaries which compliment the activities of the national government.

The State Parliaments are subject to the provisions of both their own state constitution and the Australian Constitution. Broadly, the division of powers between the Australian and the State Parliaments follows the American model.

The States administer:

1. education
2. transport
3. law enforcement
4. health services
5. agriculture

An important trend in recent years has been an increasing involvement of the Australian government in the items mentioned above, in conjunction with the states.

3. About 900 "local government" bodies concerned with matters of a local or regional nature at the city, town, municipal, or shire level.

Local government powers vary from state to state in managing the following aspects of government:

1. town planning
2. construction and maintenance of roads, streets, bridges, water, sewage, and drainage systems

3. public health and sanitary services
4. supervision of building
5. administration of slaughtering
6. weights and measures and other regulations
7. development and maintenance of parks, recreation grounds, swimming pools, public libraries, and community centers
8. transport systems
9. gas or electricity reticulation

1.4 POPULATION

Australia has approximately 14.3 million people (United States 226.5, Texas 14.2), about 120,000 of these are Aboriginal in descent. The others are of British and European origin.

There is sparse settlement in Australia, 4.7 persons/sq. mile contrasted to 70/sq. mile in the United States.

1.5 SIZE

Land area in Australia is made up as follows.

Total Area (Figure 2)

Australia: 7,686,884 km^2

Nearly the size of the Continental United States (excluding Alaska)

Pastoral Area:

Australia: 54% of the land mass

United States: 36% of the land mass

Crop Land:

Australia: 3% of the land mass

United States: 20% of the land mass

Unusable Land for Agricultural Enterprises

Australia: 40% of the total land area

United States: 13% of the total land area*

*Includes desert, swamps, rock, and tundra conditions.

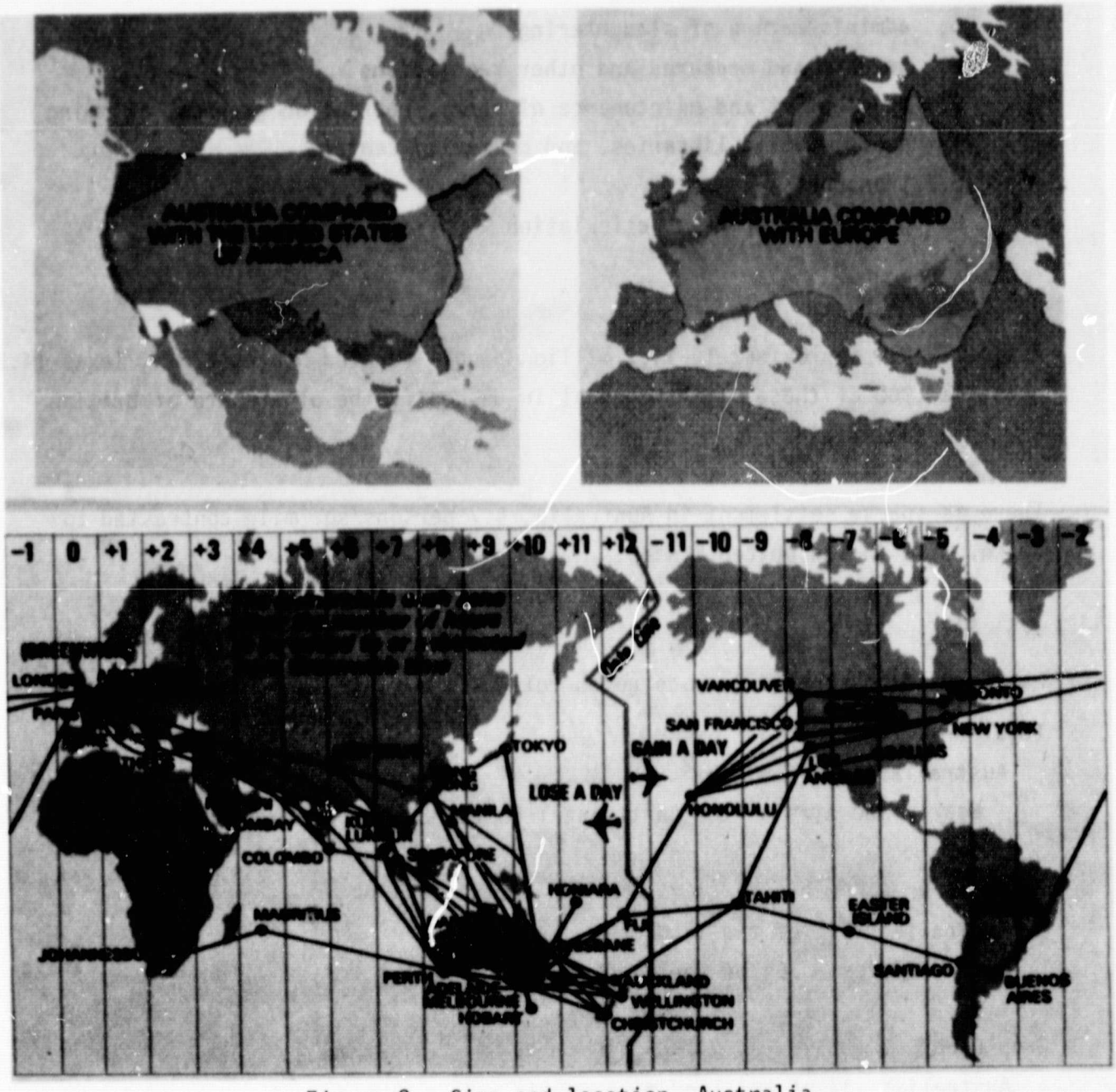

Figure 2.- Size and location, Australia.
(Source: Australia Tourist Commission.)

1.6 LAND USE (FIGURE 3)

Land use in Australia is divided as shown in figure 3.

1.7 TOPOGRAPHY (FIGURE 4)

Australia is geologically old. Its main highlands lie immediately adjacent to the south-east and east coastal areas and have been weathered to low levels. Its greatest elevation is Mount Kosciusko at 7,300 feet, in New South Wales. West of this low mountain range and comprising three-fourths of the land mass is a low and irregular plateau which is the dominant feature of the continent.

Narrow coastal regions flank this great interior area, and in the east and west there are numerous river systems. These systems are characterized by being short in length, comparatively swift in flow, and unnavigable far from their mouths. River systems flowing westward and southward into the great central basin are longer, with only slight degrees of fall once out of the highlands, and many of them either dry up or carry a very low volume of water in the dry season.

1.8 CLIMATE (FIGURES 5 AND 6)

The climatic characteristics of Australia are primarily influenced by its latitudinal location, its area and moderate land relief features, and the fact it is the only large land mass in an otherwise oceanic hemisphere.

LATITUDINAL INFLUENCE:

About one third of Australia lies north of the Tropic of Capricorn, and the bulk of the country lies outside of the track of both the Antarctic storm system, which is most active in South and Southeast Australia in winter, and the tropical monsoonal storm system, most active in North Australia. Australia lies in the Southern Hemisphere in a latitudinal situation that, in the Northern Hemisphere, is comparable with Mexico and the southern states of the United States.

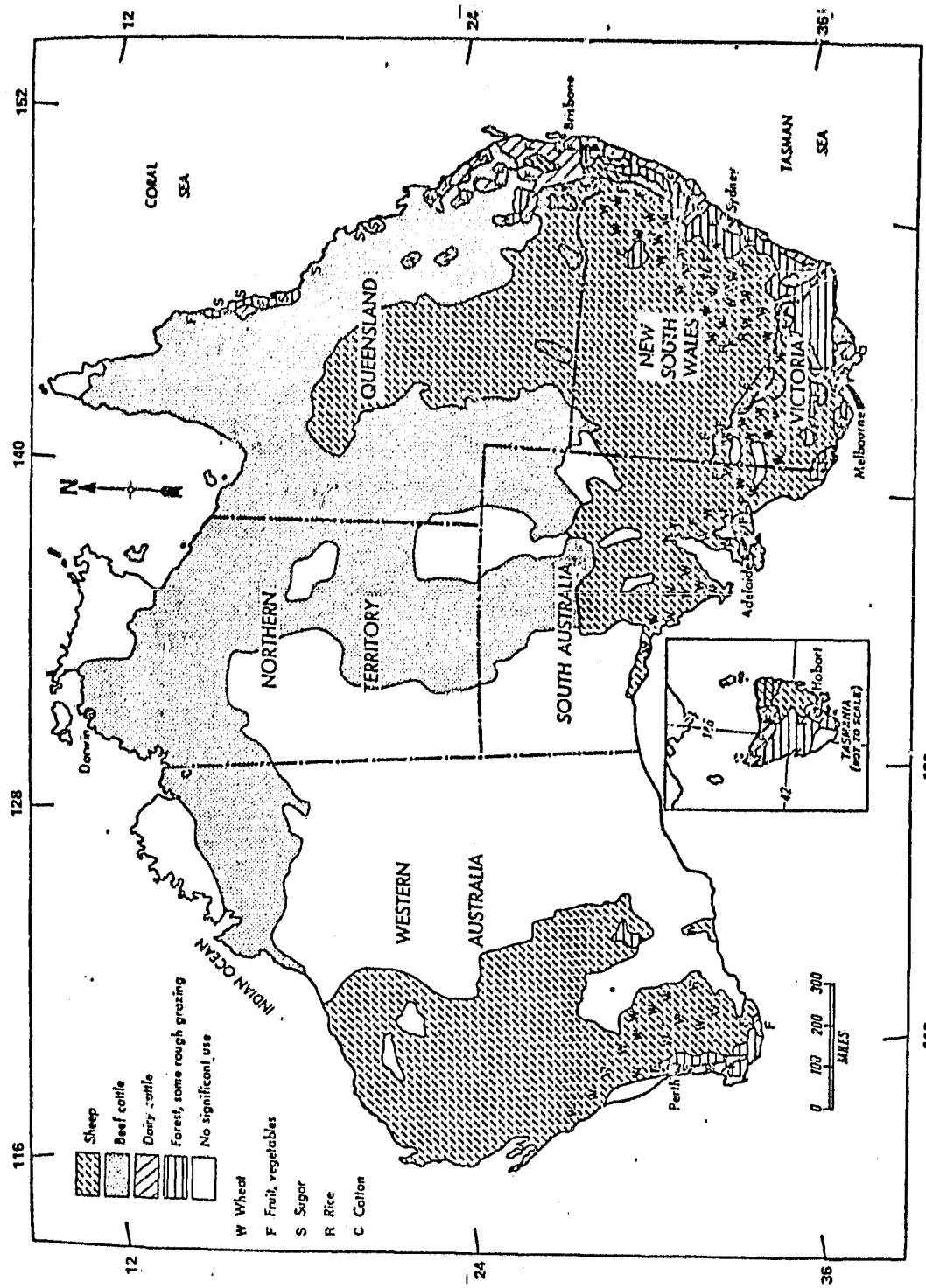

Figure 3.- Land use, Australia. (Source: Area Handbook for Australia, 1974.)

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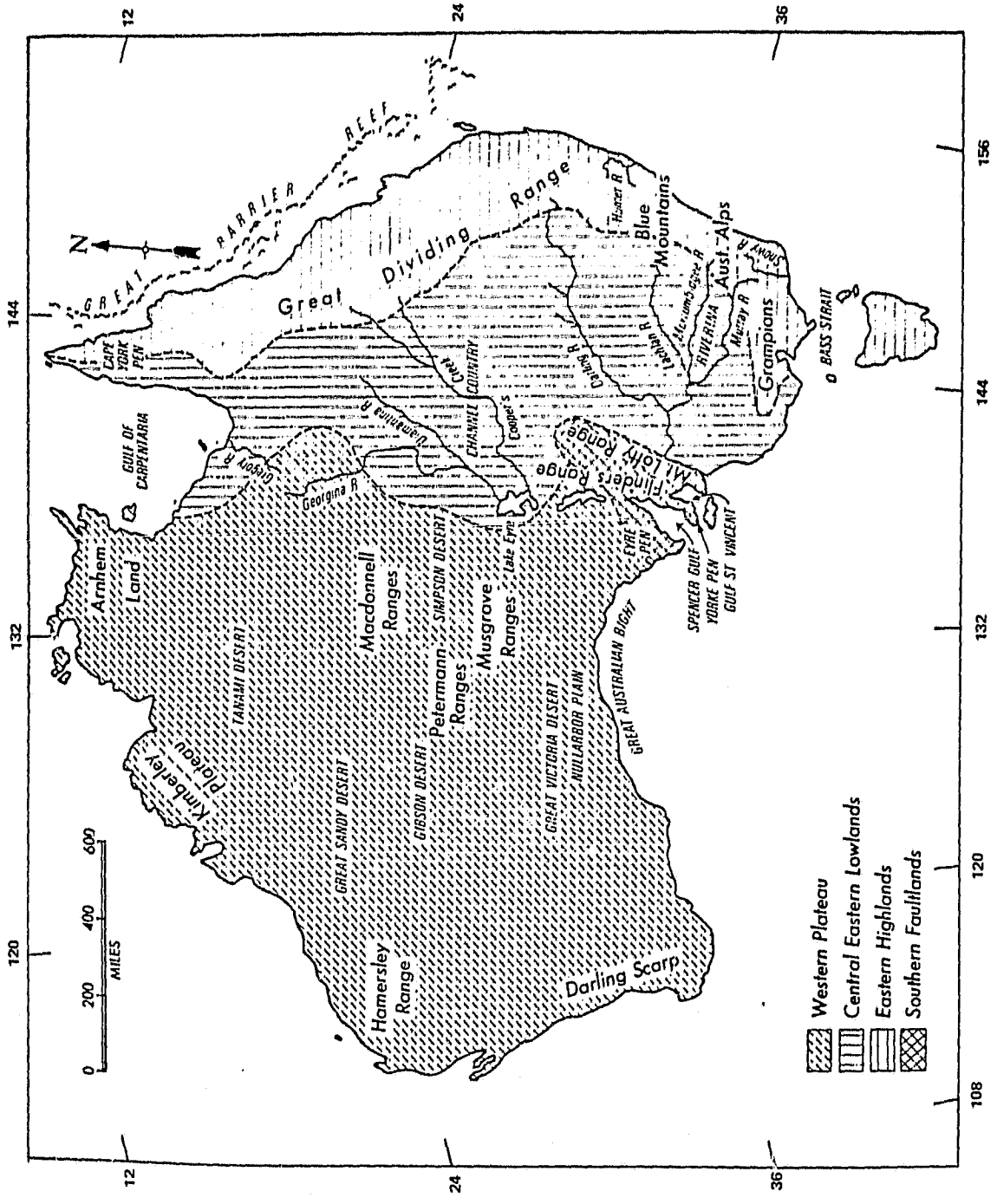

Figure 4.- Physical features, Australia. (Source: Area Handbook for Australia, 1974.)

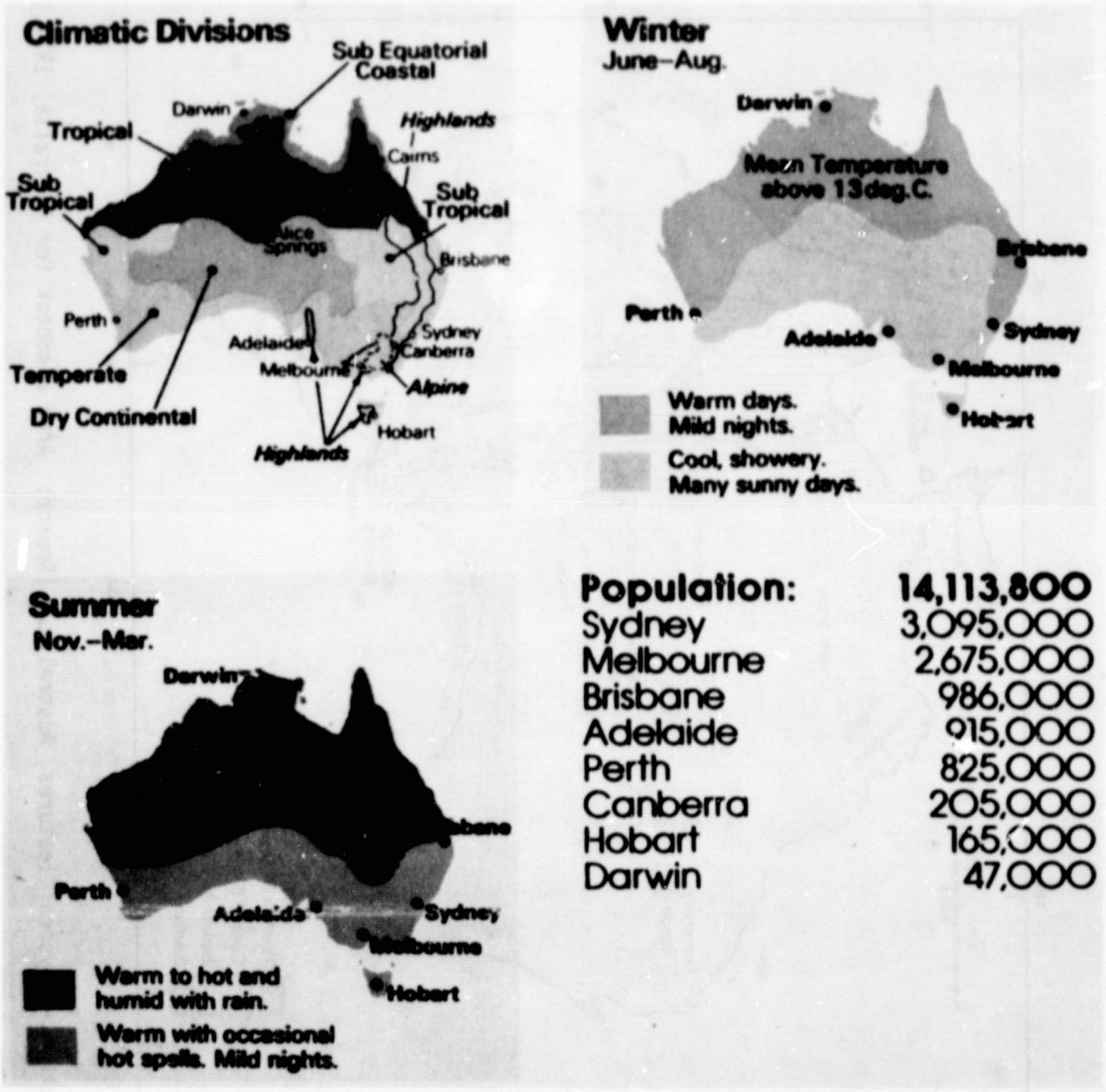

Figure 5.- Climatic divisions and population, Australia.
(Source: Australia Tourist Commission.)

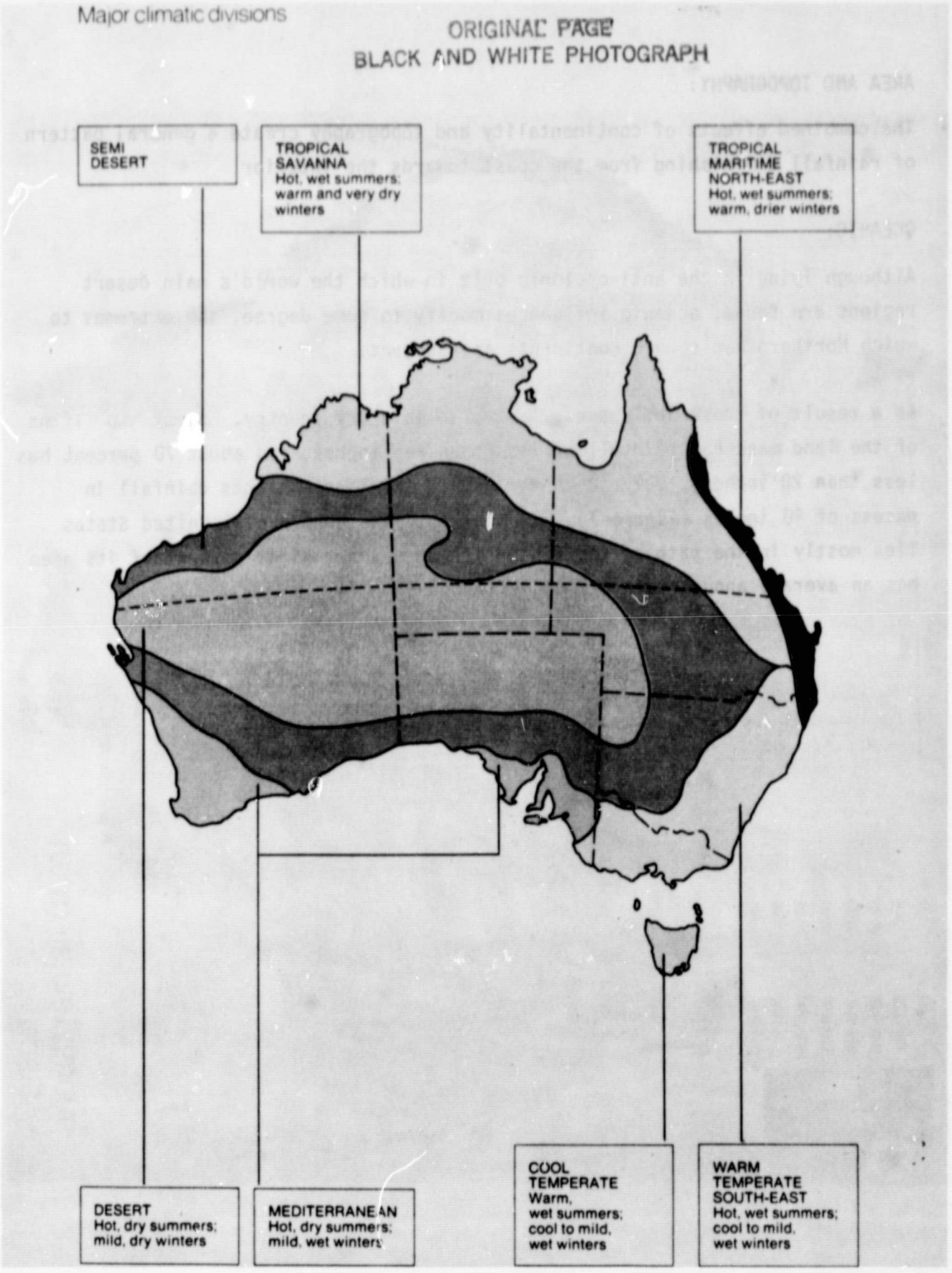

Figure 6.- Major climatic divisions, Australia.
(Source: Australia Handbook 1975.)

AREA AND TOPOGRAPHY:

The combined effects of continentality and topography create a general pattern of rainfall diminishing from the coast towards the interior.

OCEANIC:

Although lying in the anti-cyclonic belt in which the world's main desert regions are found, oceanic influences modify to some degree, the extremes to which Northern Hemisphere continents are subject.

As a result of these influences, Australia is a dry country. About two-fifths of the land mass has rainfall of less than ten inches, and about 70 percent has less than 20 inches. Only seven percent of the land mass has rainfall in excess of 40 inches (Figure 7). In contrast, the continental United States lies mostly in the path of the westerlies, and about 43-44 percent of its area has an average annual rainfall of 40 inches or more.

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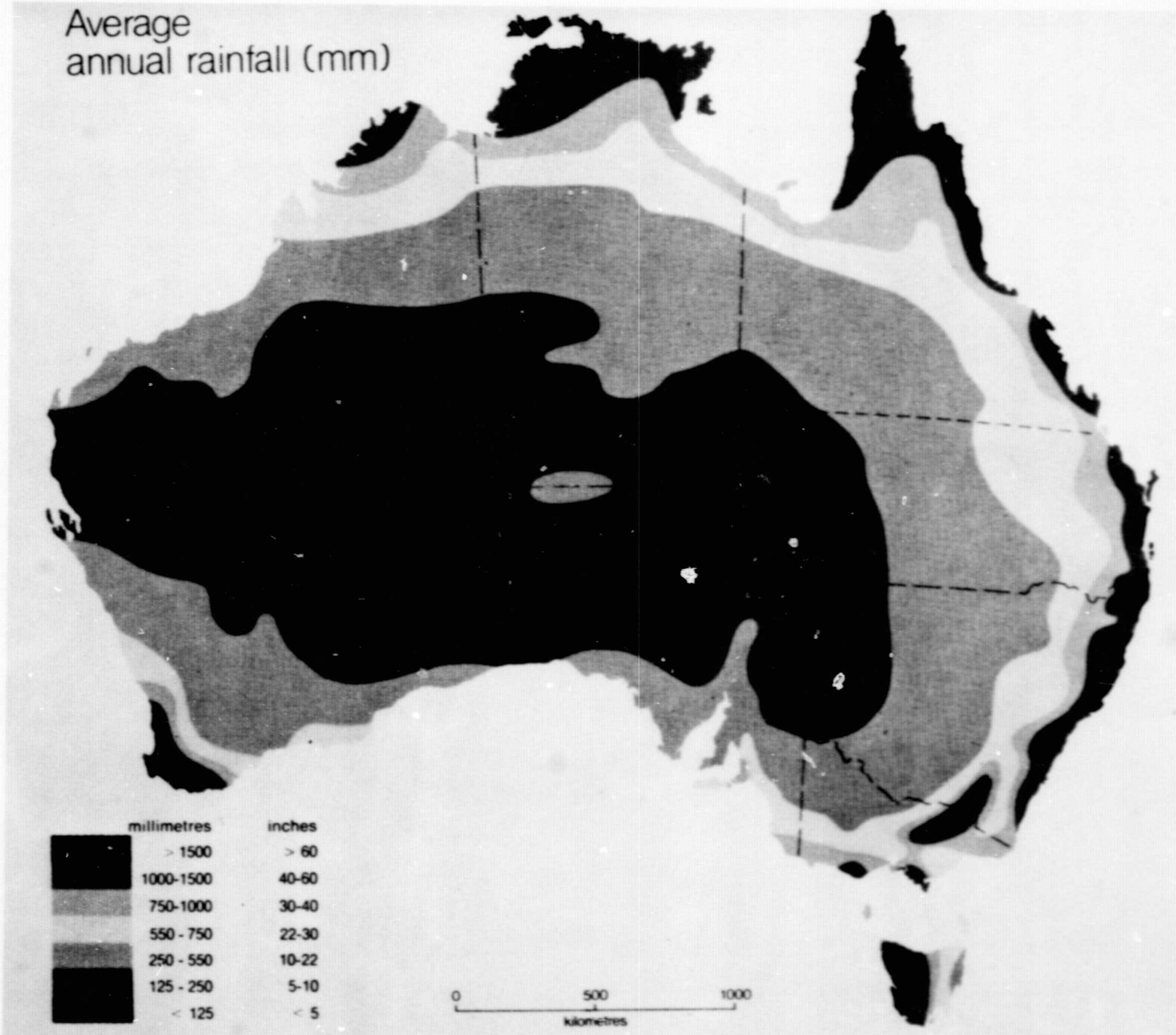


Figure 7.- Average annual rainfall, Australia. (Source: Australia Handbook 1975.)

2. AREA OF AgRISTARS INTEREST

2.1 AREA OF AUSTRALIA WHERE WHEAT IS GROWN (FIGURE 8):

Wheat is grown in the following areas of Australia.

1. New South Wales
2. Western Australia
3. Victoria
4. South Australia
5. Queensland

The Northern Territory, Tasmania, and the Australian Capital Territory (A.C.T., Canberra) contain little or no wheat.

2.2 FOREIGN INDICATOR REGION (FIGURE 9)

A part of the experiment design for the AgRISTARS program requires the identification of foreign areas of interest for exploratory and pilot experiments. Full foreign country estimates are not within the scope of the experiment objectives; therefore, indicator regions that are representative of important country conditions were needed at sub-country levels.

The country conditions are:

a. Areas of high production for crops of interest (Table 1),

b. Representative of crop varieties and cropping practices encountered throughout the country, and

c. Agronomic trends which generally affect national production.

Based on these conditions, New South Wales and Western Australia were selected as the indicator regions.

2.3 U.S. FOREIGN SIMILARITY REGION (FSR) (FIGURE 10)

This is an area or areas in the United States that have conditions similar to those that are found in Australia. The Foreign Similarity Region is to be used to support error modeling, and development or adaptation of technology to conditions of a foreign country where little or no ground truth data are

TABLE 1.- AUSTRALIAN CROP STATISTICS FOR WHEAT

(a) Production Statistics

States of interest	5-Year average production, 1971-72 to 1975-76		10-Year average production, 1966-67 to 1975-76	
	Metric tons (1000)	Total, %	Metric tons (1000)	Total, %
New South Wales	3 289	32	3 763	36
Western Australia	3 155	31	2 933	28
Victoria	1 691	16	1 691	16
South Australia	1 338	13	1 350	12
Queensland	635	6	656	6
TOTAL	10 108	[a]98	10 393	[a]98

(b) Area Statistics

States of interest	Area planted in wheat, 5-year average, 1971-72 to 1975-76		Area planted in wheat, 10-year average, 1966-67 to 1975-76	
	Hectares	%	Hectares	%
New South Wales	2 669 373	32	2 929 524	34
Western Australia	2 687 768	33	2 675 722	21
Victoria	1 119 960	13	1 188 188	14
South Australia	1 133 077	13	1 164 062	13
Queensland	497 203	6	524 665	6
TOTAL	8 107 291	[a]97	8 482 161	[a]98

[a]Australian Capital Territory and Tasmania and Northern Territory not included.

TABLE 1.- Concluded.

(c) Yield Statistics
(Metric tons/Hectare)

States of interest	5-Year average, 1971-72 to 1975-76	10-Year average, 1966-67 to 1975-76
New South Wales	1.22	1.28
Western Australia	1.15	1.09
Victoria	1.47	1.41
South Australia	1.16	1.14
Queensland	1.27	1.22
TOTAL	1.23	1.22

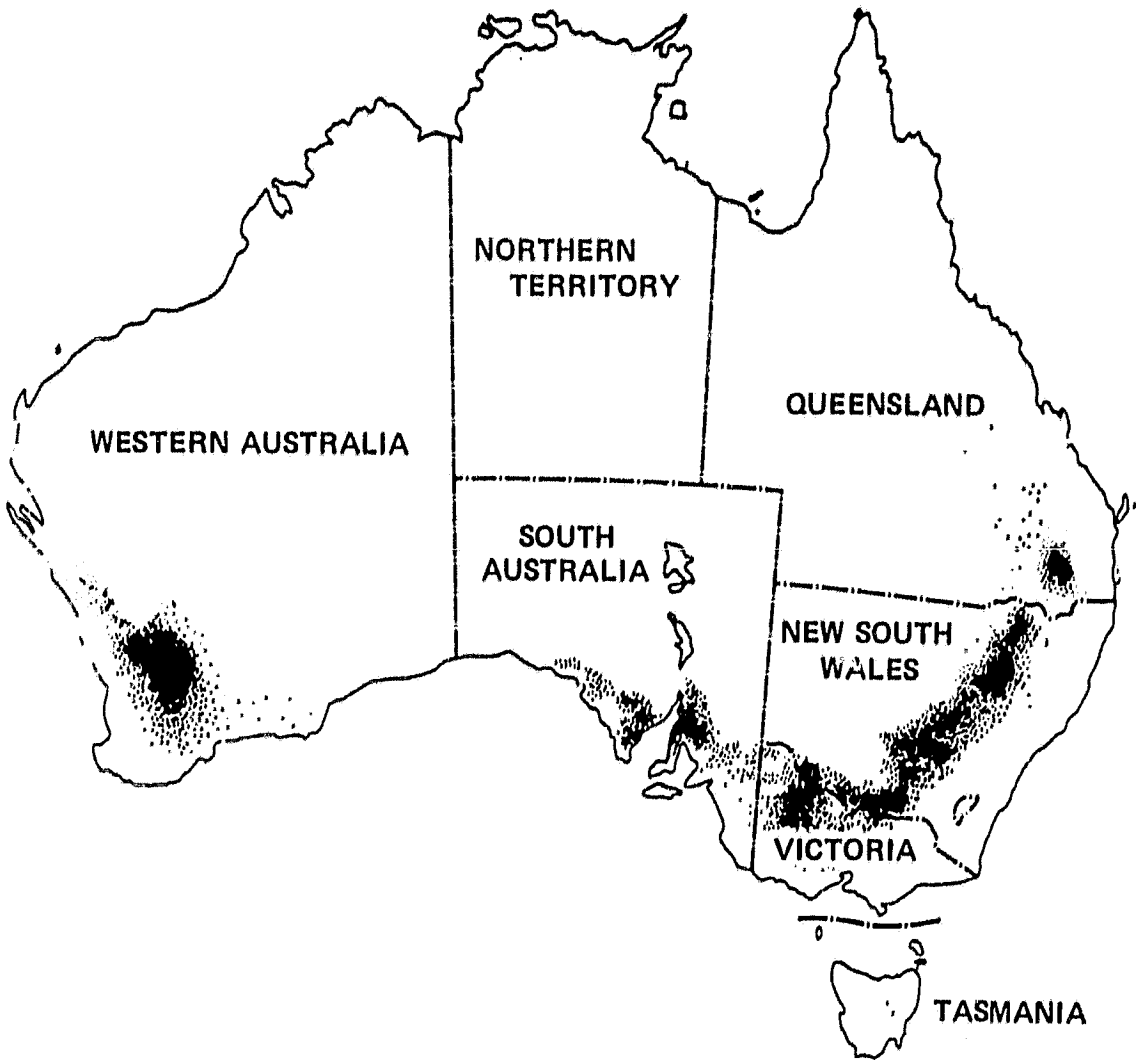


Figure 8.- Wheat regions, Australia. (Source: Australia Wheat Board, Australia Annual Report 1972-73.)

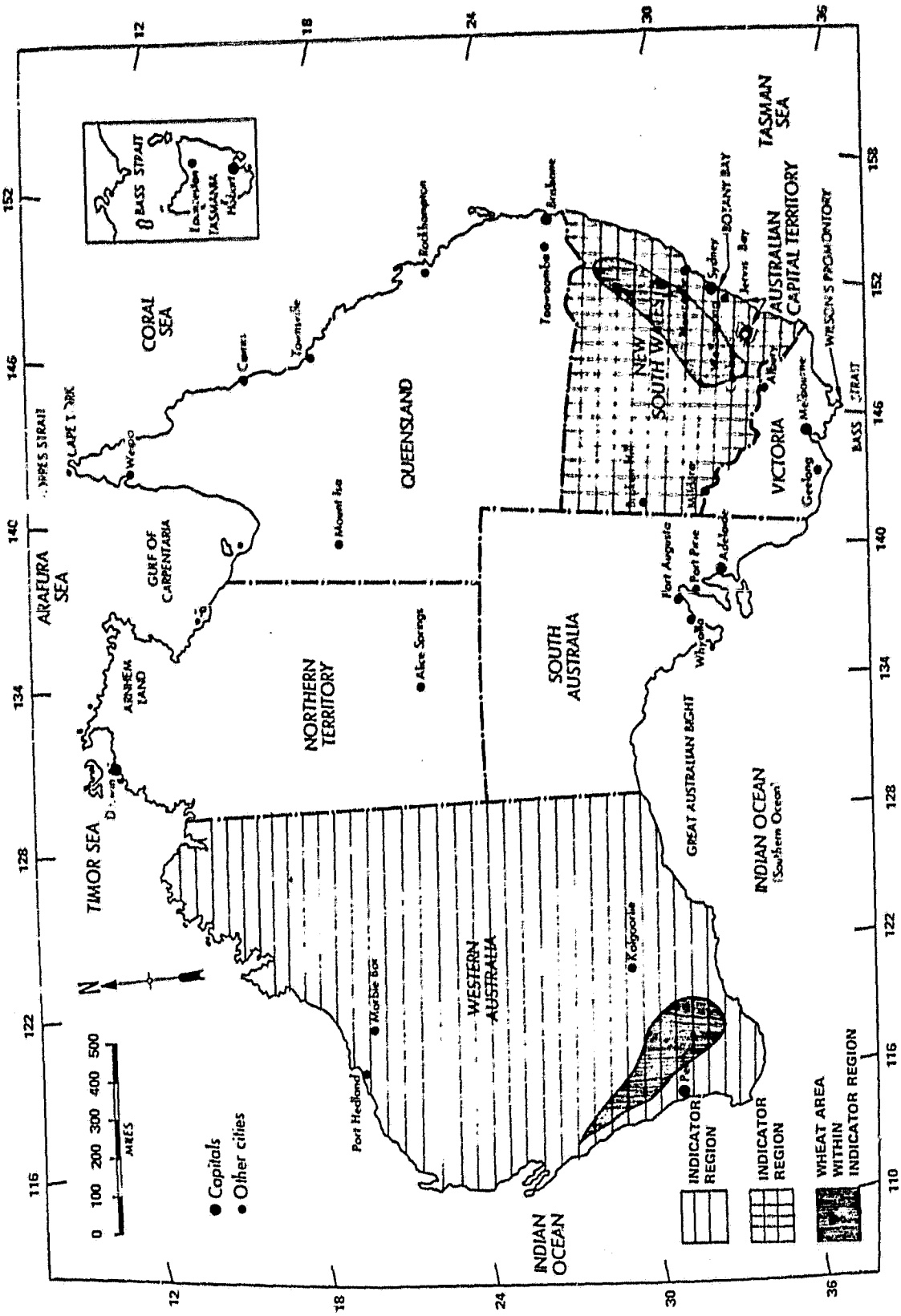


Figure 9.- Australia Indicator Region.

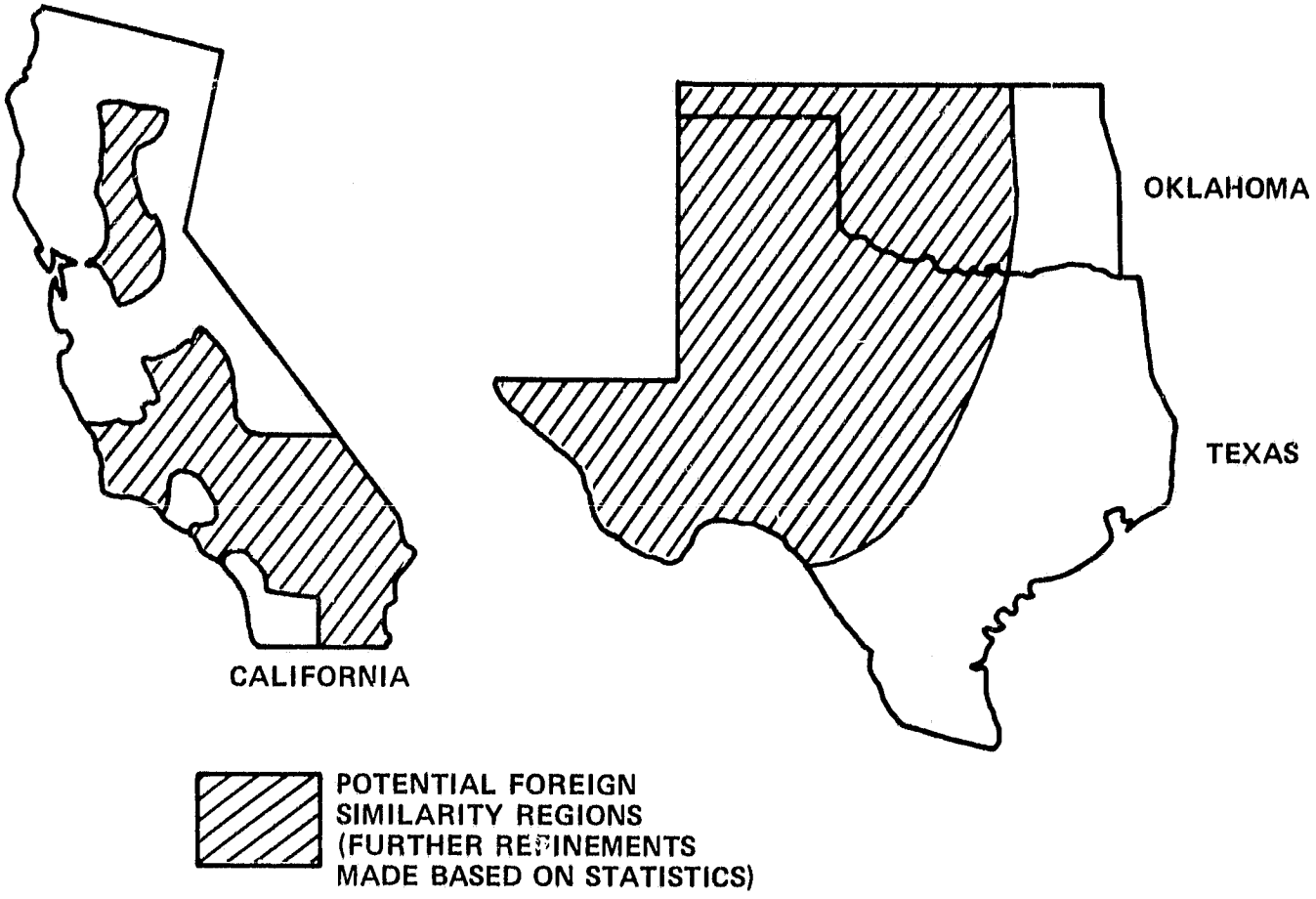


Figure 10.- Foreign similarity regions in the United States.

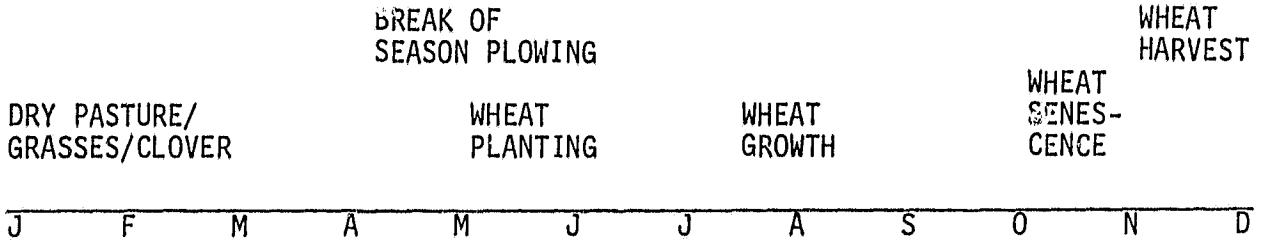
available. Foreign Similarity Regions are not meant to be analogous regions but are meant to be as similar as possible in these conditions, in order of importance:

1. climate
2. crop mixture
3. crop densities
4. growing season/crop calendar
5. field sizes
6. cropping practices

3. AGRICULTURE

3.1 GROWING SEASON

Wheat grown in Australia consists principally of varieties which have spring growth habits (i.e., these varieties do not undergo vernalization). These varieties are sown in late May or early June after the rains, during the Southern Hemisphere's fall season (but they can be sown as late as August). Winter temperatures are sufficiently mild, permitting active growth even through July and August. Heading normally occurs during October, with harvest in late November and December, though in some years harvest carries through January.



3.2 HISTORICAL AREA, YIELD, AND PRODUCTION

RANK IN WORLD PRODUCTION (WHEAT, FEED)

Australia is one of the world's leading surplus food producing countries. Most of the wheat and barley and half of the oats crop are grown for grain.

Australia ranked fourth in world wheat exports and sixth in world feed grains during 1971-72 and 1975-76. The United States ranked first in both, followed by Canada and France for wheat (Table 2), and France, Argentina, Canada and South Africa for feed grains.

The United States had an estimated 25.2 million hectares harvested in 1979-80 when 2.43 million hectares were part of the set-aside program. The record area harvested was in 1976-77 when 28.65 million hectares were harvested, with no set-aside program in operation.

Figures to compare to Australia are not available for harvested area, but if one compares Australia's area sown to U.S. area harvested, it is as follows:

TABLE 2.- WORLD MARKET SHARES OF THE MAJOR WHEAT-EXPORTING COUNTRIES

[1965/66 - 1977/78 Average]

U.S.A.	40%
CANADA	21%
AUSTRALIA	13%
ARGENTINA	5%
EEC (1)	9%
OTHERS	12%

(1) EXCLUDING EEC INTRATRADE BETWEEN ORIGINAL SIX MEMBERS UP TO FEBRUARY 1973 AND BETWEEN THE NINE MEMBERS FROM THAT DATE.

SOURCE: INTERNATIONAL WHEAT COUNCIL (1979)

	AREA*	
	1976-77	1979-80
U.S. (Harvested)	28.65	25.2
Australia (Sown)	8.96	11.2 (estimate)

*10^6 hectares

3.3 EXPORTS AND DOMESTIC CONSUMPTION OF WHEAT (FIGURE 11)

Australia exports (1978-79) about 80% of the wheat, and 60% of the barley produced.

The United States exported 41.5 million metric tons in the 1980 season out of 64.3 million metric tons produced or 64.5%.

The Australian Wheat Board handles the marketing of the wheat produced in Australia. The Australian Wheat Board has commitments to supply wheat under long term agreements negotiated with the countries listed below. (As of 1979, Wheat Board Review).

China

In January 1979, the Board signed an agreement to supply the People's Republic of China up to 2.5 million metric tons of wheat per year for three years until 1981.

Egypt

An agreement to supply one million metric tons of wheat per year to Egypt will continue until 1981.

Algeria

A three-year agreement to supply between 50,000 and 100,000 metric tons of wheat per year will continue until mid-1981.

Abu Dhabi

A three-year agreement to supply varying amounts of Australian wheat to Abu Dhabi will continue until the end of 1981.

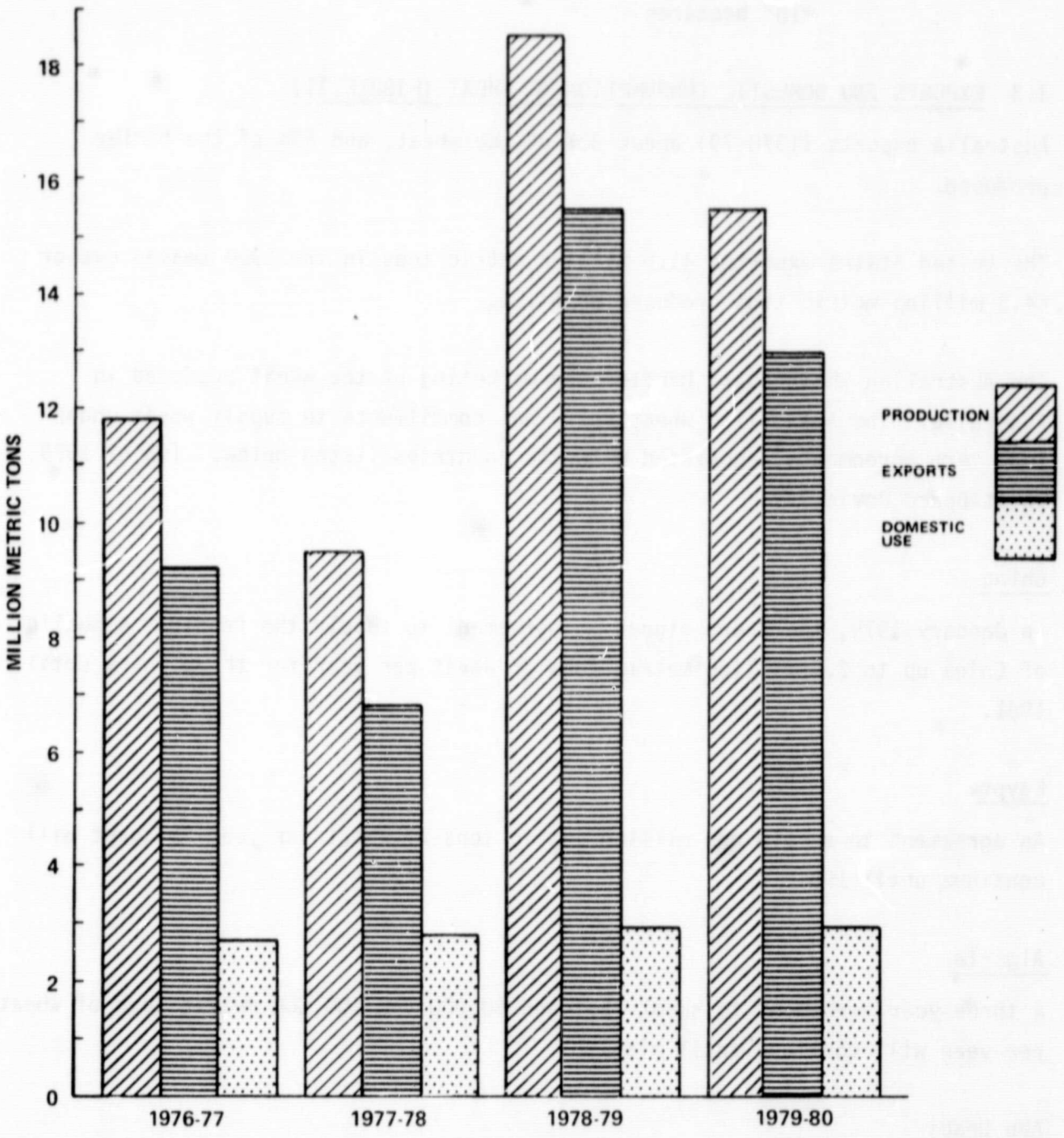


Figure 11.- Wheat production, exports, and domestic use, Australia.
(Source: Quarterly Review of the Rural Economy.)

The major importing countries of Australian wheat (78/79) are as follows.

Asia: China, Japan
Middle East: Iraq, Yemen (Sana)
Africa: Angola
USSR

Percent production by each wheat-producing state (10 year average 1970-71--1979/80) (See Figure 12).

6.4	Queensland (728.7)*
36.5	New South Wales (4151.7)
16.6	Victoria (1885.2)
11.3	South Australia (1282.6)
29.1	Western Australia (3308.9)
99.9	Subtotal
0.1	(Tasmania, A.C.T.)
100.0	Australia (11362)

Historical yield of wheat is shown in Figures 13 and 14.

3.4 FIELD SIZE AS VIEWED FROM LANDSAT

Landsat path/row number 98-84, November 26, 1979 (Figure 15)

This scene is in the state of New South Wales. The meandering river in the lower third of the scene is the Murrumbidgee. The oval patches (dark signatures) to the north and south of the river on the left side of the scene indicate an area of irrigated rice lands. The wheat/small grain areas in the rest of the image appear as an off-white harvest signature. The reddish rectilinear areas appearing throughout the scene are areas of trees (pine). The city of Wagga Wagga appears as a blue signature on the right edge of the frame just south of the river.

Landsat path/row number 118-82, August 22, 1979 (Figure 16)

This scene is in the state of Western Australia, covering an area of agriculture and sheep raising on the left side of the frame to the drier margins of the outback to desert moving to the right. Along the brown area on the right of the frame the distinct boundary of the emu fence line can be seen. The brown area is eucalyptus scrub. The eucalypt is found throughout the scene in small rectilinear patches. The small blue areas scattered throughout the scene are

*Production in 1000 metric tons

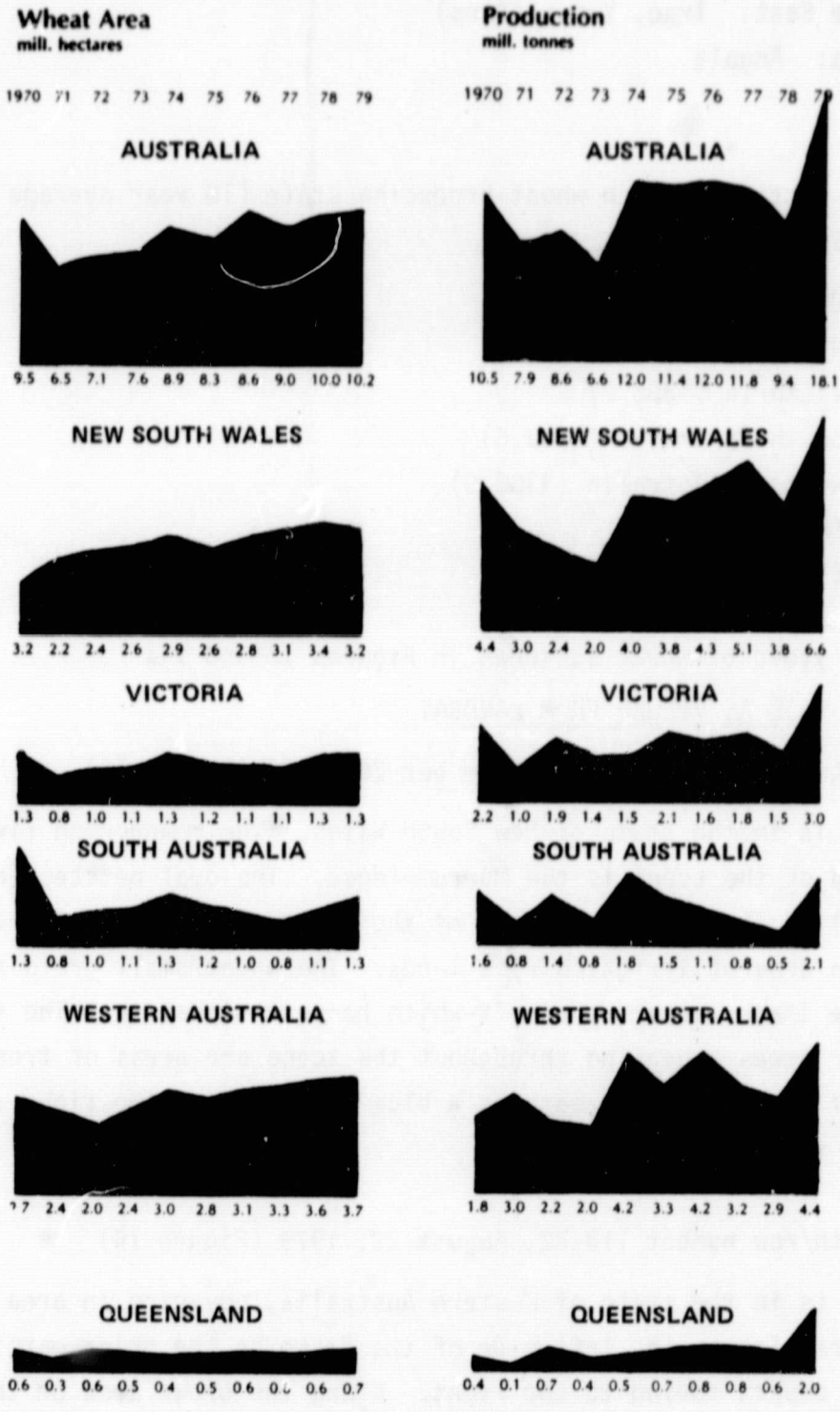


Figure 12.- Historical wheat area and production, Australia by state. (Source: Australian Wheat Board, 1979 Review.)

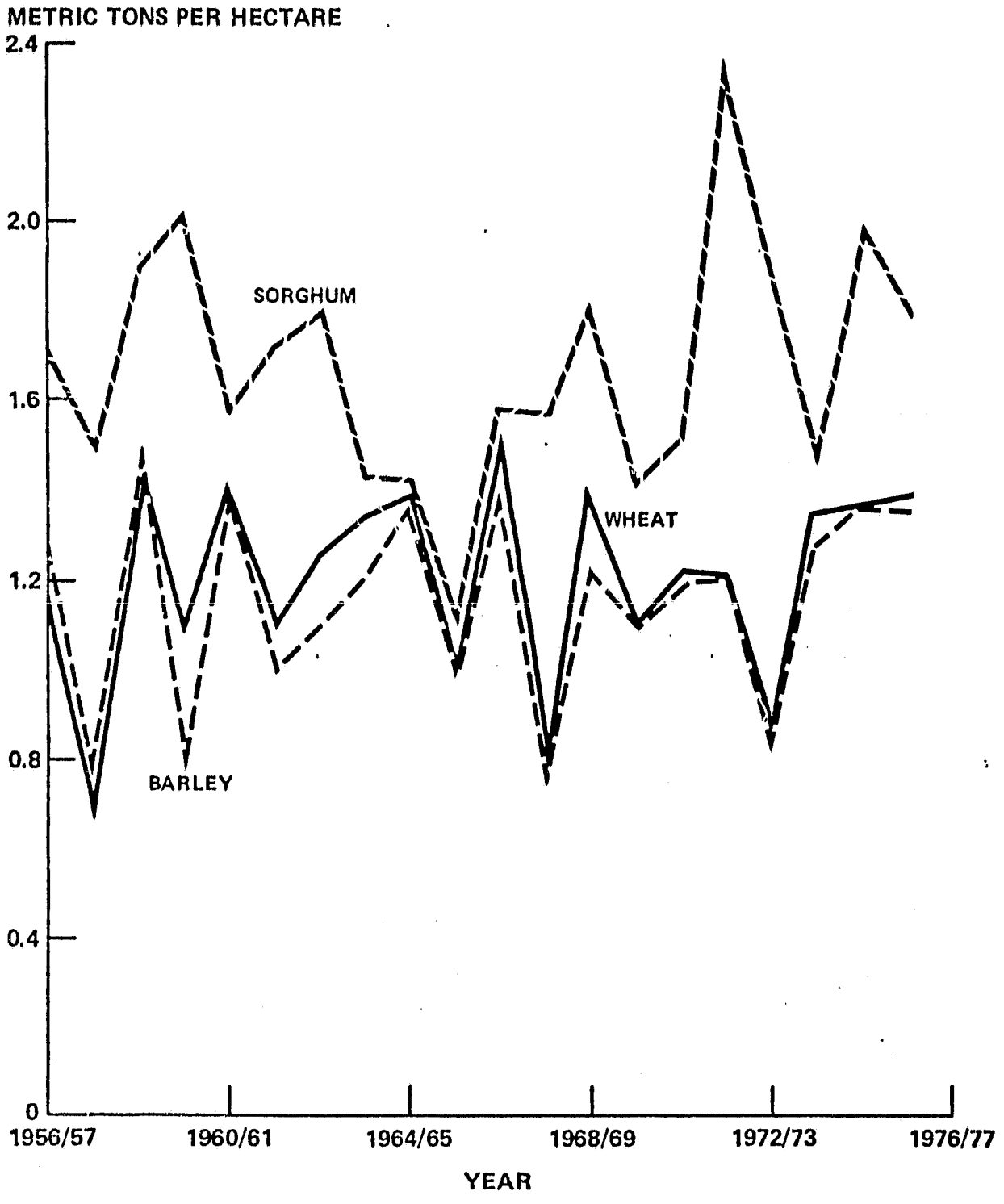
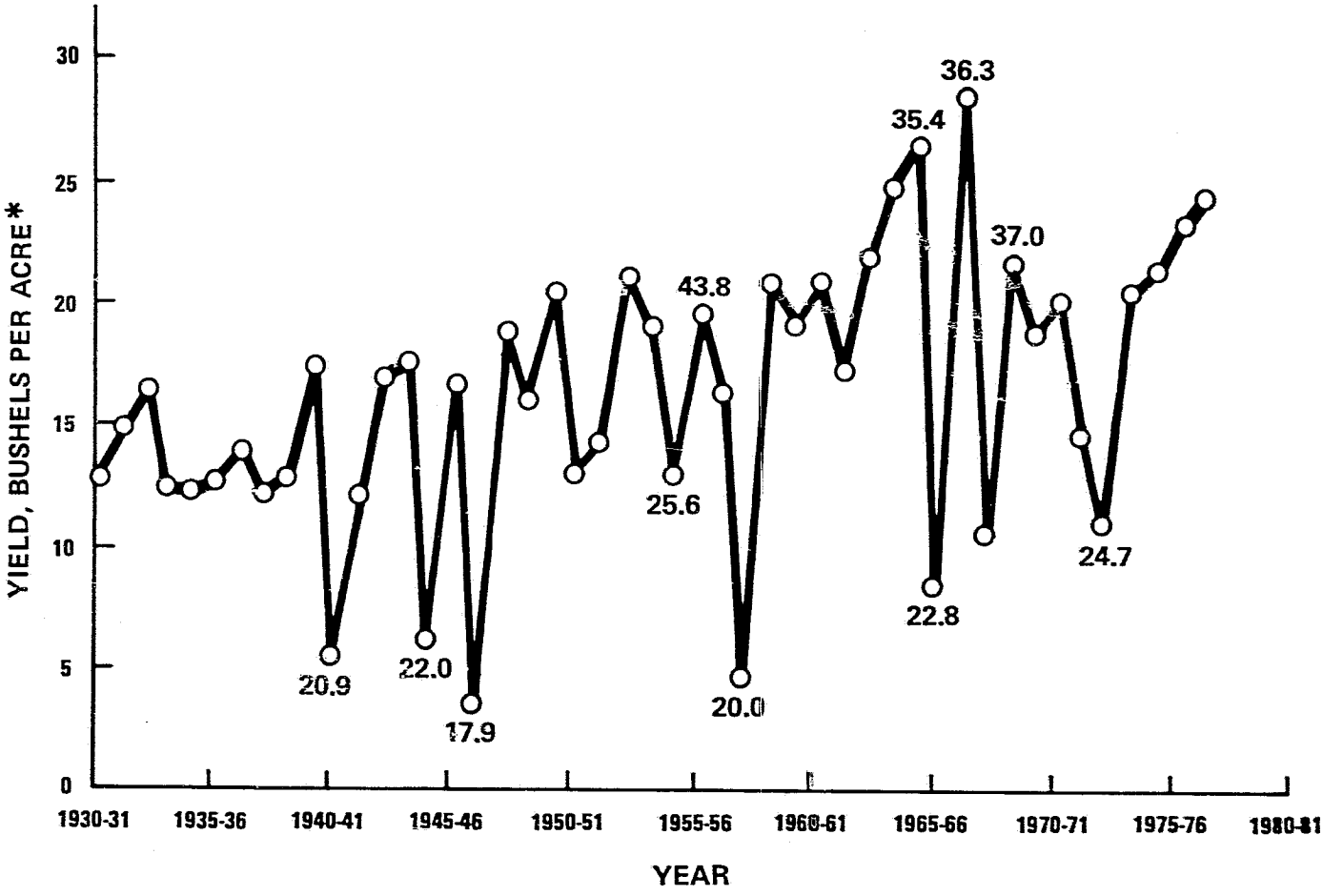


Figure 13.- Yields of sorghum, wheat, and barley for Australia. (Source: An econometric analysis of export supply of grains in Australia.)



NORMAL ACCUMULATED PRECIPITATION FOR MARCH–OCTOBER IS 35.5 cm.

*Metric tons per hectare = $\frac{\text{bushels per acre}}{14.87}$

Figure 14.- Average wheat yields since 1930, New South Wales, Australia.

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH

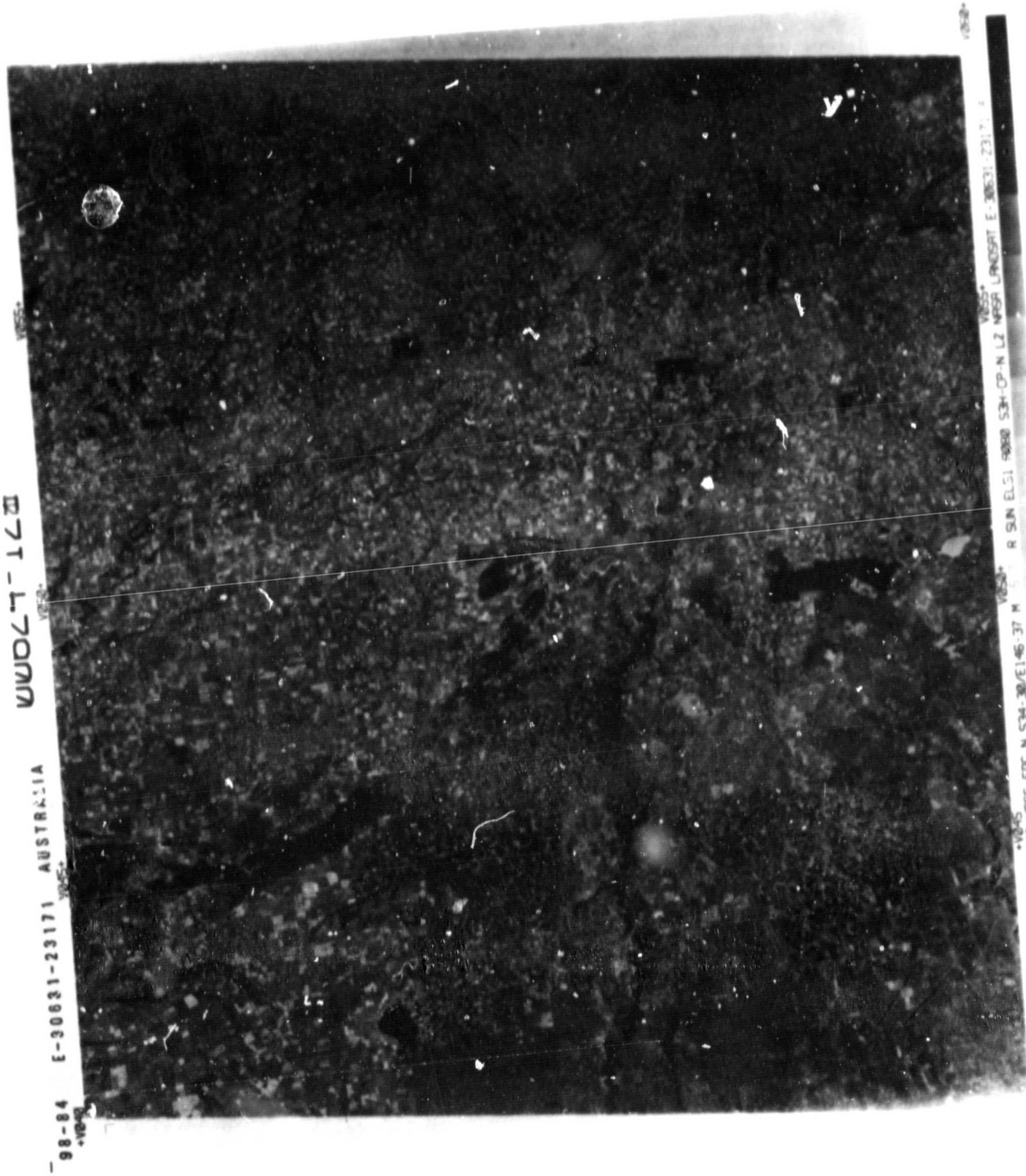


Figure 13.- Landsat image, New South Wales, Australia.

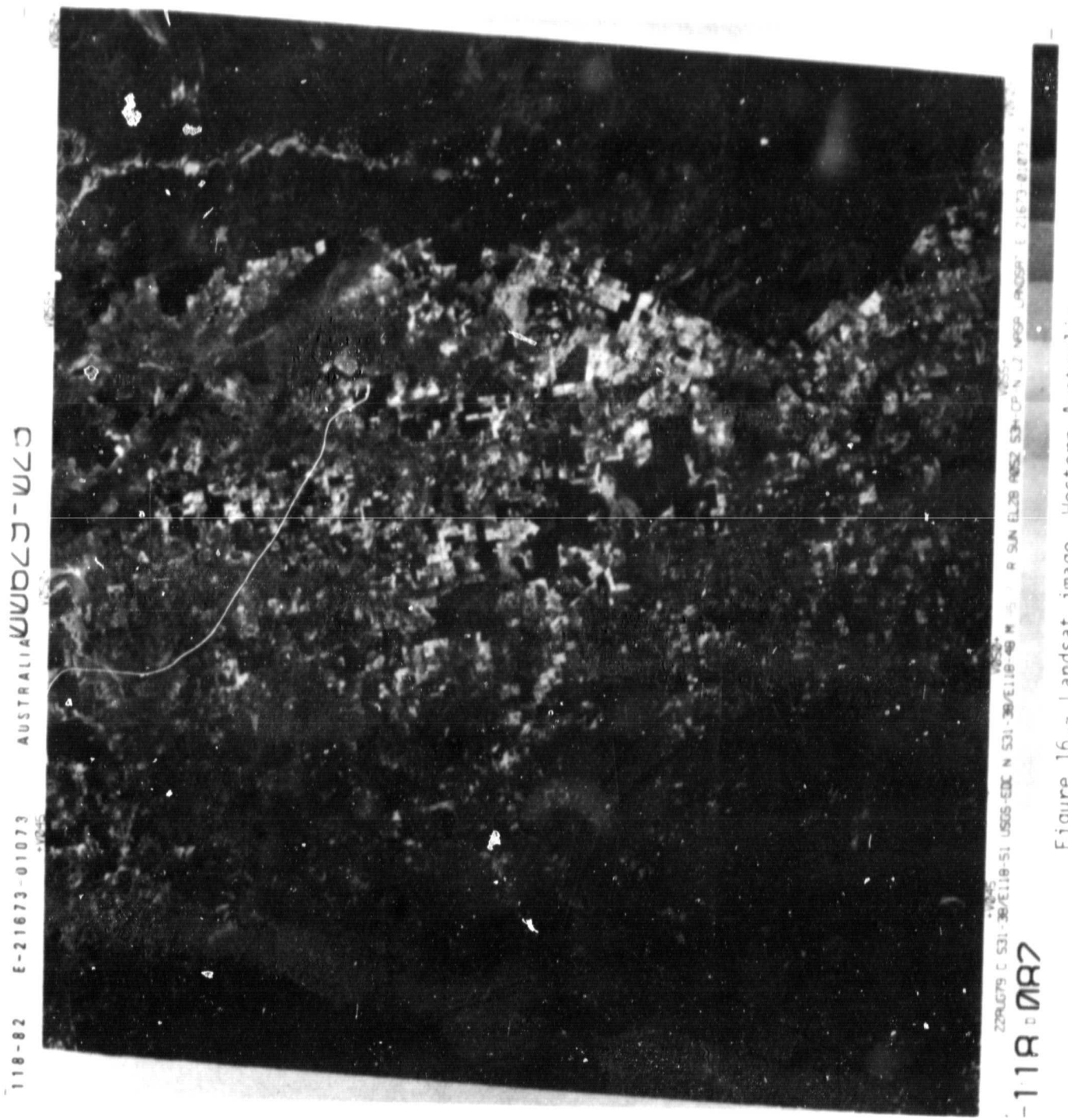


Figure 16.- Landsat image, Western Australia.

intermittent lakes and streams. The area on the left is a grain and sheep raising area, the dark red fields are small grain fields, the light red pastures and clovers, and the odd yellowish green is a weedy grass.

3.5 CROP ROTATIONS AND CROP MIXES

The major crops grown in association with wheat are barley and oats with natural and improved pasture.

Western Australia

In Western Australia, most wheat farms raise sheep or other livestock. As a result, most wheat land is subject to rotation involving some form of pasture. A paddock (field) may only be cropped for wheat, barley, or oats in two of five years, and be sown to pasture for the other three. This rotation helps maintain soil fertility and reduce erosion.

In lower rainfall areas, many farmers continue to use a wheat-natural pasture system of cropping because, in some areas, no suitable legumes are available to grow productive pastures on some soils.

Lupins provide some fertility to a following cereal crop. In a pasture-crop rotation, higher yields are more likely when lupins are sown after a cereal as broad-leafed weeds are usually better controlled and the land is easier to work. Problems in seeding after a legume pasture or lupin crop arise from the possibility of severe disease attack and the greater competition from grass weeds resulting from the nitrogen build-up.

New South Wales

Ley-farming is the common practice. Some farmers practice a wheat-fallow-fallow-wheat-grass (weed) rotation. In the past, the rapid spread of skeleton weed made changes in cropping essential. Some farmers turned to grazing, others chemical spraying and then the adoption of the ley farming system in which pasture plants compete with the weed. Some crop rotations include grain sorghum. Grain sorghum is summer grown, raised principally on the wheat lands of Northern New South Wales and on into Queensland; it is more suitable to higher temperature climates and more drought-resistant than maize (corn). Grain sorghum can be sown and harvested with the same equipment as wheat and fits in well with crop rotation on wheat farms. In summer rainfall areas, such as the area of Northern

New South Wales and on into Queensland, grain sorghum is often sown following a failure of the wheat crop in order to supplement farm income and to meet livestock feeding requirements. Two factors have significantly influenced the marked expansion in the area under grain sorghum: the increased availability of irrigation water and the rapidly expanding Japanese market for the grain.

3.6 IRRIGATION OF WHEAT

Wheat is seldom irrigated since the Australian varieties are bred for dry conditions, and most irrigation is reserved for the higher valued crops such as rice and cotton.

In New South Wales, the expansion of areas of irrigated wheat are largely in the central and north-northwestern regions, although the total area of irrigated wheat in these areas is considerably less than in southern New South Wales.

ESTIMATED AREAS OF IRRIGATION IN NEW SOUTH WALES

Area	Estimated area of irrigated wheat hectares	
	1975-76	1976-77
Macquarie Valley	10,000	16,500
Namoi Valley	9,000	13,500
Gwydir Valley	900	14,500
Coonable District	1,500	2,500
Other	1,000	1,000
Southern New South Wales	86,000	95,000

In Western Australia, about 40 percent of the wheat produced comes from areas receiving less than 325 mm (12.8") of average annual precipitation, yet the wheat is grown dryland and irrigation is used on improved pasture.

Irrigation is also used on improved pasture in New South Wales. In the 1975-76 crop season, irrigated pastures (sown and native) comprised about 282,000 hectares of the 602,550 hectares of irrigated land in New South Wales. They were predominantly of winter growing types of annual rye grass and subterranean clover.

3.7 STRIP CROPPING FOR EROSION CONTROL

Erosion-control strip cropping has been identified on the Landsat imagery in small amounts in New South Wales in the slightly sloping black soil areas of the northwest slopes and plains. Soils in these areas have a high natural fertility and an extremely high water-holding capacity; but since the infiltration rate of the soils can be low (3-4 mm per hour), runoff can be high. Since there are extensive areas of these soils, the volume of runoff during heavy rains can be very great.

Pasture improvement is one defense against soil erosion. Pastures may be sown with cereal grains, which are harvested first, leaving the pasture species underneath to flourish and reduce erosion.

In the past, the grazing of sheep and cattle was the main land use, so erosion was not a serious problem; however, with more land being utilized for crops each year, erosion is increasing significantly.

3.8 FERTILIZERS--NEW SOUTH WALES

Tests conducted on farmer's experiment plots indicate that benefits derived from the application of superphosphate to wheat lands are most marked in the southern slope and southern plains agricultural areas, which comprise the southern portion of the wheat belt. The beneficial results gradually diminish in the central portion of the wheat belt, and the least advantage is gained in the heavier and phosphate-bearing soils of the north-western districts.

Applications of nitrogen fertilizer have greatly increased yields in many situations, but this measure provides only a short-term solution. Increased usage of leguminous-type crops is needed to replace the nitrogen in the soil. In the winter-rainfall regions of the south, a subterranean clover rotation system has been successful; however, it has not worked as well in the north

where legumes do not fit in well with the established cropping practices. In wheat farming areas in which this system has been incorporated, cropping of grain legumes such as lupins, soybeans, and mung beans reveals that biologically-fixed nitrogen is both more economical and superior to commercial nitrogen fertilizer.

FERTILIZERS--WESTERN AUSTRALIA

Western Australia has been by far the greatest user of fertilizer in terms of quantity applied; this is consistent with the magnitude of cropping, especially of wheat. However, unlike other states, Western Australia uses a large amount of fertilizer on improved pasture.

Most of the soils of Western Australia have low inherent fertility, and without the use of fertilizers, they cannot support the growth of commercial crops. Practically all soils in the southwestern part of the state need phosphorus fertilizers, which must be applied when the crop is planted. Many of the sandy soils are also deficient in trace elements: copper, zinc, manganese, molybdenum. To compensate for this deficiency, small amounts of these elements are added to fertilizer mixtures for deficient soils. Nitrogenous fertilizers are commonly used and are very profitable for certain soils, especially the newly developed sandy soils. In addition to use of fertilizers several years under leguminous pasture plants (usually subterranean clover) build up the soil's organic matter and moisture-holding ability, and increase the amount of nitrogen available for crops. This sequence of cropping for one or more years after one or more years of fertility-building pasture, is known as "ley farming". This is the usual system in the wheat belt. The intensity of cropping reduces and the period of pasture between crops increases, in passing from low to higher rainfall areas.

3.9 DISEASES AND PESTS IN NEW SOUTH WALES

These are the major diseases of wheat and their effects:

Take-all in Australia is likely to be serious on light textured or poorly compacted soils, on land that has previously been under pasture, on alkaline soils, and where growing conditions are unfavorable. It has proved particularly troublesome in irrigated crops and in wheat grown on land restored to fertility by a long period under clover-grass pasture.

Stem Rust usually does not cause conspicuous damage until late in the season. It attacks all the above-ground parts of the plant and is particularly serious when it develops on the upper portions of the stems during the grain-filling period. The occurrence and severity of the disease is closely related to weather. Warm, humid weather with frequent showers and heavy dews is particularly favorable for development of rust.

Powdery Mildew of Wheat is a common disease of wheat in New South Wales but in most seasons it does not cause sufficient damage to reduce yields. The disease is most prevalent in the winter and early spring in seasons of high rainfall. In moist, warm weather it may develop rapidly, causing appreciable damage.

Flagsmut of Wheat is a fungus. Twenty years ago it was regarded as a very serious disease of wheat in New South Wales. However, wheat varieties resistant to this disease were developed and their widespread use led to a marked decline in the incidence of flagsmut. This was the case until the varieties Gabo, Gamenya, Mengaui, and Mendos were introduced. These are all susceptible to flagsmut, and as a result, this disease has reappeared and is causing serious economic damage in some areas where these susceptible wheat varieties are widely grown.

Common pests to New South Wales include:

Rabbits, plague locust, feral pigs, kangaroos, emus, winged grasshoppers, wingless grasshoppers, and noxious weeds such as Bathurst and Noogoora Burr, Variegated and Saffron Thistle, Patterson's Curse, Fireweed and wild oats.

Some controls of these pests:

Rabbits: controlled by the disease myxomatosis and the European Rabbit Flea.
Plague locust hatchings: ground spraying supported by aerial detection.
Feral pigs: controlled by poisoning.
Kangaroos: culling by shooting.

3.10 DISEASES OF WHEAT, AND PESTS IN WESTERN AUSTRALIA

The main crop pests, red-legged earth mites, weevils, and webworm, are fairly easily controlled by insecticidal sprays, but for most economical control, spraying must be carried out before the pests have caused much damage.

Septoria, Takeall, and Stem Rust are the main diseases of wheat in Western Australia. In the higher rainfall areas, wheat yields can be considerably reduced by Septoria diseases which produce blotches and spots on the leaves, stems, and heads of wheat plants. Stubble burning and use of rotations may reduce the amount of disease carried over from one year to the next. Varieties resistant to septoria diseases are also being developed.

Take All is a widespread root-rotting disease which is most serious in higher rainfall wheat growing districts. The heads contain little or no grain. Rotations which include legumes, oats, or linseed help to reduce the incidence of the disease. There are no recognized resistant wheat varieties.

Stem Rust can cause heavy losses to wheat crops in some areas in years when it is able to survive through summer and growing season conditions are favorable for its development and spread. Widespread losses due to rust are very rare in Western Australia. The only economical way to control it at present is to use resistant varieties. New strains of rust which attack varieties previously resistant are continually appearing.

Webworm, the larval stages of four different species of moths, attack the young plants during winter. A period of fallow in summer, or at least a few weeks in autumn helps to control them. Insecticidal sprays must be used to control them in some crops in some seasons.

Weevils are a serious problem and, if not properly controlled, can damage stored grain. They can live from harvest to harvest in pockets of grain left in grain storages and in grain handling machinery. They can be best controlled by completely cleaning empty storage and machinery and by treating grain with special protectants.

Wild Oats - Wild Oats is an agricultural weed that is now a problem in all Australian states. In the 1960's, it became obvious that the density of wild oats increased rapidly with multiple cropping. Multiple cropping gave little opportunity for control by grazing which reduces seed setting considerably. A wild oat infestation reduces the yield of a wheat crop; they are also considered a contaminant in harvested grain and are subject to dockage by grain handling authorities.

Control - Control depends upon the species involved. One species is easily controlled by a single cultivation; another species requires a minimum of three prior years pasture, with regulated grazing to stop seed formation. Pre-crop cultural treatments should be designed to kill as many weeds as possible; herbicide treatment can also be used but is unlikely to give an economical return in low-yielding crops.

3.11 CROP NOT HARVESTED AT MATURITY (E.G. ABANDONMENT, GRAZING, SILAGE, GREEN CHOP, ETC.)

Since wheat is planted in the dry margins of Western Australia wheat belt each year, the risk is great and abandonment occurs to some extent each year. A good record is harvest 2 years out of 5 years. Abandonment can occur throughout Australia, as early as just after sowing. In some years when the rains are late, preplanting procedures are delayed and a late crop may not be able to be re-sown if it fails. Abandonment can occur then at any time--after planting, because the crop did not germinate, or any other time up until harvest maturity of the crop.

Some fields are intentionally sown for grazing; other fields may be grazed if the pastures and reserve feeding hays and grains are depleted due to drought. Oats for the most part is grown for animal feed, which can then include green chop and silage.

3.12 VARIETIES OF WHEAT

Wheat and other small grains are usually planted at about the same time in late May through June. They are then harvested from late November through

December and in some years, through January. Short growth (late-planted and thus shorter season) wheat varieties are grown throughout the dry margins.. Australian wheat varieties are bred for dry conditions.

Each year in Western Australia, recommendations for grain crop varieties are made based on a wide testing program sponsored by the Department of Agriculture. Some 8,000 plots are sown on 60 trial sites throughout farming areas to compare varieties. New varieties are compared with commercial varieties; grain quality as well as yield is considered before recommendations are finalized. Proposals for recommendations and the release of new wheat varieties are submitted to the State Wheat Advisory Committee. Proposals for grains other than wheat are submitted to the State Coarse Grains and Seeds Advisory Committee. These committees (which include grower, marketing, and grain-handling representatives) examine the proposals before final recommendations are released.

Recommendations for wheat varieties to be sown each year are given according to grades. The Australian Standard White (ASW) is the main grade received at most sidings (see Table 3). Australian Hard and Australian Soft are produced in specific areas and are received only at sidings nominated each year by the Australian Wheat Board.

In New South Wales, wheat variety recommendations are formulated after examination of marketing, handling, and varietal information and are based on agreement among the wheat growers' organizations, the Grain Elevator Board of New South Wales, the Australian Wheat Board, the flour millers and stockfeeders associations, and the wheat breeding organizations. The recommendations are reviewed by the New South Wales Standing Advisory Committee on Wheat. In varietal control, the main aims are to reduce the need for unnecessary segregation in bulk storage, enhance the specification of existing and potential wheat grades, and give greater flexibility in matching the inherent qualities of varieties to the special needs of grain users. Three major components are studied to formulate the new recommendations: varieties available (either currently in use or developed to a stage for rapid seed increase); the protein content of the grain in each silo; and the silo facilities available for segregation.

TABLE 3.- GRADES OF AUSTRALIAN WHEAT (1978-79)

Australian Prime Hard

Queensland
13 per cent min. protein
New South Wales
14 per cent min. protein
New South Wales
13 per cent min. protein

Australian Hard

No.1 Queensland Southern
No.2 Queensland Southern
No.1 New South Wales
No.2 New South Wales Northern
South Australian
Western Australian

Australian Standard White

Queensland Southern
New South Wales Northern
New South Wales Southern/Western
Victorian
South Australian
Western Australian Northern
Western Australian Southern

Australian Standard White (soft varieties)

Victorian

Australian Soft

Western Australian

Australian Feed

New South Wales Northern

Short-growth wheat varieties account for approximately 20% of the wheat production in New South Wales. The short-growth varieties are grown because they are "drought escaping;" that is, they mature and are harvested before the onset of drought conditions is likely. However, the varieties that require a longer period of growth are preferred since they produce higher yields.

3.13 MARKETING METHODS AND POLICIES

The Australian Wheat Board has been in continuous operation since 1939 as the statutory marketing authority with the sole right to market wheat in Australia and Australian wheat and flour overseas. It derives its authority from the Wheat Industry Stabilization Act.

Bulk handling authorities, on behalf of the Wheat Board, utilize 18 ports to load about 535 ships in the year with an average of two per working day.

During 1979, the Australian Wheatgrowers Federation and Federal and State governments negotiated new wheat marketing legislation known as the Wheat Marketing Acts. This legislation provides for the marketing of Australian wheat for five years, until 1984.

The most important improvement for the farmer as a result of this act has been the introduction of a guaranteed minimum delivery price (GMDP), paid on delivery of wheat to the Australian Wheat Board. This arrangement replaces the former first advance to the grower. The formula for setting the level of the GMDP should ensure that from the 1979-80 season onwards, growers will receive a higher proportion of the ultimate value realized from the sale of their wheat in the initial payment.

In the 1978-79 season, New South Wales implemented a program of wheat varietal control. It was designed to improve the quality of wheat available for market and reduce the number of grades of wheat handled in particular areas, if not over the state as a whole. The way in which this affects the individual grower is that he or his agent delivering wheat to a Grain Elevator Board (G.E.B.) silo will be required to make a signed statement as to the variety of wheat

being delivered in each truckload. When the scheme is fully implemented, growers will be able to deliver only certain nominated varieties to particular silos without incurring a dockage. When this program is fully implemented, it is expected to improve the quality of New South Wales wheat crop and, in a limited way, help reduce segregation costs.

The Australian Wheat Board has undertaken a program of technical market servicing and promotion work. The Board regards the seminars and exchanges taking place as part of this program as a most effective way of ensuring that Australian wheat and Australian milling and baking technology is well understood and accepted in the market place.

4. DATA COLLECTED DURING LACIE AND AgRISTARS

4.1 METEOROLOGICAL

Australia's distribution of meteorological stations is sparse. It is confined primarily to the populated coastal areas rather than the agricultural areas.

Data in-house consists of synoptic data (data taken every three hours) from the mid-1960's to September 1977. The quality of this data is unknown. From September 1977 through May 1981, daily meteorological data are available. Long term normals (climatological data) for approximately 30 years are also available.

Also available are two Australian publications for which AgRISTARS is on the mailing list: (1) Monthly Rainfall Review (monthly publication) by the Department of Science and the Environment, Bureau of Meteorology, and (2) Drought Review by the Department of Science and the Environment, Bureau of Meteorology. This is published only when a drought has been declared.

4.2 AGRICULTURAL

The Australian data collected through the LACIE and AgRISTARS programs have been cataloged on an Agricultural Data Inventory form (Figure 17) according to category number and name of generic data (Figure 18 is the generic list). For the most part the data are in these categories:

- 1.0 Agricultural Statistics
  - 1.1 Area
  - 1.3 Production
  - 2.1 Varieties
    - 2.1.1 Varietal Characteristics
  - 2.2 Management Practices
    - 2.2.4 Irrigation
      - 2.2.4.1 Area Irrigated
    - 2.2.5 Fertilizer Usage
    - 2.2.6 Pesticide Usage
  - 2.4 Diseases and Insects
    - 3.3.1 Maps

AGRICULTURAL DATA INVENTORY FORM

Country AUSTRALIA

Figure 17.

1. Category Number and Name of Generic Data

1.1 Area

1.3 Production

Document or Data Item Available

2. Title and Identifying Number Western Australia, Grain and Other Crops and Cereal Varieties Season 1973-74 W. 112-/74

3. Publisher or Source Australian Bureau of Statistics Western Australian Office

4. Date Published or Prepared 18 November 1974

5. Periodicity of the Data: Daily ☐ Weekly ☐ Monthly ☐ Quarterly ☐ Annual ☒ Other ☐

6. Geographic Area Covered Western Australia

7. Political Subdivision Level(s) of the Data Statistical Division, Local Shire

8. Crop Types Covered Wheat, Oats, Barley, Lupins

9. Crop Year(s) Covered 1973-74

10. Location(s) of the Data File C. Reed

11. Format of Data: Hard Copy ☒ Microfische ☐ Computer Tape ☐ Disc File ☐ Other ☐

12. Responsible Custodian(s) C. Reed / Statistician

13. Comments

Name of Compiler C. REED Date 7 / 31 / 81 (M / D / YR)

Figure 17.- Agricultural data inventory sheet, Australia.

FOREIGN AGRICULTURAL DATA REQUIREMENTS

GENERIC LIST

In all cases, specification of data requirements must include crop(s) of interest, years for which data is required, and the administrative subdivision level at which the data is required.

1.0 Agricultural Statistics

- 1.1 Area - specify if area estimates are on a planted or harvested area basis
- 1.2 Yield - specify if yield is per planted or harvested unit area
- 1.3 Production
- 1.4 On-farm usage and storage of production

2.0 Non-Statistical Agricultural Data

- 2.1 Varieties - specify respective area planted to each
  - 2.1.1 Varietal characteristics
    - 2.1.1.1 Origin
    - 2.1.1.2 Trial results and recommendations
    - 2.1.1.3 Planting and harvest dates (distribution)
    - 2.1.1.4 Growth stage dates (distribution)
    - 2.1.1.5 Yield potential
    - 2.1.1.6 Insect and disease resistance
    - 2.1.1.7 Seeding rates (distribution)
    - 2.1.1.8 Tolerance to pesticides
    - 2.1.1.9 Response to fertilizers
    - 2.1.1.10 Environmental tolerances (temp., precip., etc.)
- 2.2 Management practices (specify crop(s) and administrative subdivision)
  - 2.2.1 Tillage practices
    - 2.2.1.1 Seedbed preparation
    - 2.2.1.2 Weed control (mechanical)
    - 2.2.1.3 Other (specify)
  - 2.2.2 Planting practices
    - 2.2.2.1 Row widths (and distribution) and direction (if applicable)
    - 2.2.2.2 Depth
    - 2.2.2.3 Seeding rates (distribution)
    - 2.2.2.4 No-till; minimum till (amount)

Figure 18.- Generic list of foreign agricultural data requirements.

2.2.3 Harvest practices
2.2.3.1 Windrowing, etc.

2.2.4 Irrigation
2.2.4.1 Area irrigated
2.2.4.2 Amount
2.2.4.3 Frequency
2.2.4.4 Method (e.g., drip, pivot, furrow, etc.)

2.2.5 Fertilizer usage
2.2.5.1 Rates (distribution)
2.2.5.2 Type
2.2.5.3 Application time and method

2.2.6 Pesticide usage (herbicides, insecticides, fungicides)
2.2.6.1 Rates
2.2.6.2 Type
2.2.6.3 Application time and method

2.2.7 Crop rotations and crop mixes

2.2.8 Crop not harvested at maturity
2.2.8.1 Abandonment (rate and circumstances)
2.2.8.2 Grazing (rate and circumstances)
2.2.8.3 Silage, green chop, etc. (amount and circumstances)
2.2.8.4 Other

2.2.9 Other (e.g., land clearing and subsequent management practices)

2.3 Field size (specify crop(s) and administrative subdivision)

2.3.1 Distribution (spatial and size) (distribution by region)

2.3.2 Shape (length and width)

2.4 Diseases and insects (specify crop(s) and administrative subdivision)

2.4.1 Historical severity

2.4.2 Progression (i.e., contraction and development, symptoms, affects, methods of control)

2.5 Marketing methods and policies affecting production

2.6 Special studies (e.g., salinity, others)

2.7 Crop Calendars

Figure 18.- Continued.

3.0 Physio-Georgraphic Data (specify administrative subdivision)

3.1 Soils

3.1.1 Detailed Soil maps

3.1.2 Classification

3.1.3 Profile descriptions

3.1.4 Physical and chemical properties

3.1.5 Productivity ratings

3.1.6 Drainage class

3.1.7 Parent material

3.1.8 Slope class and aspect

3.2 Topography

3.2.1 Topographic maps

3.3 Land use

3.3.1 Maps

3.3.2 Categories and definitions

3.3.3 Category area summaries

3.3.4 % agricultural land

3.4 Other (e.g., land clearing - annual rate, method of, time to achieve maximum productivity, etc.)

4.0 Ground Observations (specify crop(s) and administrative subdivision)

4.1 Frequency

4.2 Number of fields

4.3 Growth stages

4.4 Planting

4.4.1 Area planted

4.4.2 Planting dates

Figure 18.- Continued.

4.4.3 Seeding rates

4.4.4 Row direction and spacing

4.4.5 Emergence date

4.5 Growth

4.5.1 Canopy height

4.5.2 Ground cover

4.5.3 Surface moisture condition

4.5.4 Weediness

4.5.5 Disease damage

4.5.6 Insect damage

4.5.7 Hail and other weather damage

4.5.8 Lodging damage

4.6 Fertilizer application(s)

4.6.1 Dates of application

4.6.2 Rates of application (lbs./unit area)

4.6.3 Type of fertilizer and analysis (%N, $\%P_2O_5$, $\%K_2O$)

4.7 Harvest

4.7.1 Area harvested

4.7.2 Harvest date

4.7.3 Percentage moisture at harvest

4.7.4 Harvest method

4.7.5 Second crop

Figure 18.- Concluded.

Several other categories had small amounts of data:

1.2 Yield
2.7 Crop Calendars
3.1 Soils
4.0 Ground Observations

The states of New South Wales and Western Australia have the most complete sets of data due to two trips NASA scheduled to those states and complimentary copies of publications.

4.3 AVAILABLE LANDSAT (MSS) DATA COLLECTED DURING THE LACIE AND AgRISTARS PROGRAMS

This section contains:

1. Original allocation used in LACIE 1977-78 transition year (TY)
2. Discussion of the recommended improvement to the TY allocation
3. Discussion of the data orders in New South Wales and Western Australia to support the indicator region concept
4. Discussion of the sample segments contained in the 1981-82 Landsat data order for New South Wales and Western Australia
5. List of the Landsat data order for 1981-82 crop year

The original sample segment allocation for Australia during the Large Area Crop Inventory Experiment (LACIE) was based on a proportional wheat acreage allocation apportioning 4800 sample segments for all eight (U.S., Canada, China, India, Argentina, Australia, USSR, and Brazil) LACIE countries based on the wheat acreage for epoch year 1972.

Using this procedure, Australia's allocation was 257 sample segments based on a wheat area of 7,776,000 hectares. The segments were allocated using the shires as strata. (LACIE, Level 3 Baseline, Crop Assessment Subsystem (CAS) Requirements, Appendix A, LACIE-C00200, Volume IV (Rev. c), JSC-11329, October 1977).

This initial allocation for Australia was completed in LACIE Phase I using available data. Subsequent analysis isolated numerous inaccuracies in the historical data set used for the allocation; in addition, an incomplete allocation/aggregation hierarchy was defined. These data errors were corrected and the appropriate hierarchical elements were defined, but the work was not completed soon enough to allow evaluation and revision of the allocation prior to ordering Landsat data in August 1977 for Transition Year processing.

Therefore, the sample segments ordered for 1977-78 were based on the original allocation:

Australia	257
New South Wales	125
Western Australia	49
Queensland	16
Victoria	44
South Australia	23

No sample segment data were collected for crop year 1978-79.

A reallocation of the sample segments based on corrected historical data and a complete definition of the allocation/aggregation hierarchy was performed in April 1978 to determine how an allocation based on correct data would deviate from the initial allocation. This analysis indicated:

	Allocated	Re-allocated
New South Wales	125	88
Queensland	16	25
South Australia	23	39
Victoria	44	36
Western Australia	49	76

New South Wales and Victoria were oversampled in the original allocation and the other states were undersampled. A more detailed discussion can be found in "Minutes of Meeting Regarding Allocation/Aggregation Problems in Australia," LACIE 78-823, April 12, 1978, Roy E. Hatch/SF4.

Although the data used for the original allocation were corrected and adjustments were made to improve the initial allocation that supported TY, no new allocation over Australia was performed until after November 1978. After this time, a reallocation of 400 segments for all Australia was done.

New South Wales	167
Queensland	26
South Australia	53
Victoria	45
Western Australia	109

Actual location of these reallocated segments was not done. Goddard Space Flight Center (GSFC) started extracting the 257 sample segments based on the original allocation March 1, 1979. To do a reallocation after this time would have necessitated location and retro-processing through the GSFC LACIE Processor. The decision made was that this could not be done given time and the existing workload before the scheduled shutdown of GSFC LACIE Processor at the end of December 1979. It was not feasible to accomplish extraction of the 400 relocated segments at JSC using the LIVES program at that time. Thus, the 1979 data order corresponded exactly to the 1977 data order.

The final decision made for the 1980-81 crop year gave us a new approach. Initially, the approach for the 1980 crop year would call for collecting only New South Wales using an indicator region approach, analyzing approximately 50 segments. New South Wales was chosen because it had the highest wheat production of the states, somewhat better data availability, and contacts for potentially obtaining ground truth for accuracy assessment, as well as it was not undersampled in the original allocation. At the time of the data order for the 1980-81 crop year, the indicator region selection process was incomplete. Therefore, to allow flexibility in the experiment design for the FY82 Exploratory and FY83 Pilot, it was necessary to order data over Western Australia.

Meanwhile, events occurred which influenced the data selection. These events included Landsat mechanical problems, changes in the experiment design, and rescoping considerations which resulted in a 1980-81 crop year data order

consisting of the following:

New South Wales	61 - These are from the original allocation in the highest producing areas (includes 6 sites which have had ground observations collected).
	27 - These are potential ground truth sites with coordinates provided by the Australians.
Western Australia	43 - These are from the original allocation.

The 1981-82 crop year data order sample segments to support the FY82 Australian Exploratory Experiment includes the 131 segments from the 1980 data order plus 16 additional segments (see Table 4). Of the 16 additional sites, six are from the original allocation collected prior to 1980. Ten new (1981-82) sites are needed to complete the set of segments allocated to the Australian Indicator Region to cover all developmental work for the Exploratory. The new sites were required to fully represent the range of variability in crop mix. For example, shires with a relatively high acreage of barley and oats along with wheat were not well represented in the original (257) allocation.

A special subset of 53 segments (including the 16 segments previously described) out of the total 1981-82 order of 147 segments is for use in proportion estimation procedures development. These 53 indicator region sites were selected to represent as a group the range of variability of wheat, barley, and oats that would be observed in the country at large.

The method used in selecting the special subset of 53 segments was to first rank all the shires in the Australian Indicator Region (New South Wales and Western Australia) separately, according to the acreages of wheat, barley, and oats. Ranks of 1, 2, or 3 for high acreage or ranks of 4 and 5 for low acreage were assigned. Shires with the bottom rank of 5 contain 20% of the total crop acreage. The rest of the ranks were then each assigned 20% of the total acreage of all the shires. Using this method, the rank of 1 is composed of the top 20% of the total acreage; it represents a small number of shires. The result of this ranking is that a large area shire is more likely to have a segment selected from it than a small area shire. Ranks 1, 2, and 3 were then grouped together and ranks 4 and 5 were grouped together. A modified probability proportional to

TABLE 4.- 1981 - 82 AUSTRALIAN WHEAT EXPLORATORY SEGMENTS

STATE	SEGMENT	LATITUDE, S.	LONGITUDE, E.	INDICATOR REGION SITE	79-80 GROUND TRUTH	POSSIBLE 80-81 GROUND TRUTH
New South Wales	4004	34°21'07"	148°16'39"			
	4005	34°09'20"	148°30'04"			
	4006	34°35'08"	148°26'02"			
	4013	31°03'24"	150°10'45"	X	X	
	4014	31°07'30"	150°24'36"			
	4015	31°23'15"	150°20'03"	X	X	
	4016	31°16'51"	149°50'00"	X	X	
	4022	29°10'	150°15'	X	X	
	4030	31°01'18"	149°48'48"			
	4031	31°41'03"	149°05'01"			
	4032	30°49'39"	149°04'06"			
	4033	31°24'51"	149°27'51"	X	X	
	4036	31°32'57"	148°42'54"			
	4037	31°54'42"	148°32'01"			
	4038	31°26'24"	148°21'06"	X		
	4041	32°16'33"	147°56'21"			
	4042	31°57'00"	147°54'15"	X	X	
	4043	32°41'30"	148°06'30"	X		
	4044	32°24'12"	148°18'54"			
	4047	33°23'12"	148°42'42"			
	4048	32°52'54"	147°48'54"	X		
	4049	32°05'	147°20'	X		
	4050	33°53'12"	148°48'09"			
	4051	33°38'10"	148°39'12"			
	4052	33°47'00"	148°04'00"			
	4053	34°04'04"	147°52'42"	X		
	4054	33°45'12"	147°41'09"			
	4055	34°34'36"	147°04'03"	X		
	4056	34°42'28"	147°27'26"			
	4057	34°49'27"	147°05'33"			
	4058	34°59'42"	147°52'33"			
	4059	34°55'50"	147°37'54"			
	4060	34°39'58"	147°49'48"			
	4061	34°34'12"	148°09'51"			
	4062	35°32'00"	147°35'00"			
	4063	35°18'15"	146°28'28"			
	4064	35°26'29"	146°42'48"	x		
	4065	35°14'50"	147°03'06"	x		
	4066	34°59'00"	147°01'24"	x		
	4067	35°12'30"	147°18'00"			
	4070	34°11'	146°32'	x		
	4073	35°52'	146°31'	x		
	4080	28°57'09"	150°06'15"			
	4081	29°50'27"	149°46'03"			
	4082	28°59'00"	149°45'03"	X		
	4083	28°41'36"	150°10'09"			
	4084	29°14'42"	149°48'09"			
	4085	29°37'45"	150°05'07"			
	4086	29°33'39"	149°51'06"			
	4087	29°58'30"	149°55'00"			
	4093	30°20'45"	148°53'45"			

TABLE 4.- Continued.

STATE	SEGMENT	LATITUDE, S.	LONGITUDE, E.	INDICATOR REGION SITE	79-80 GROUND TRUTH	POSSIBLE 80-81 GROUND TRUTH
New South Wales	4094	30°34'45"	149°09'54"			
	4095	30°12'06"	149°27'55"	X		
	4096	30°27'57"	150°11'57"			
	4097	30°04'07"	149°05'45"			
	4098	30°25'04"	149°51'12"			
	4099	30°42'48"	150°07'48"			
	4100	30°44'50"	149°47'00"			
	4101	29°50'24"	149°03'36"			
	4103	30°58'12"	148°37'54"			
	4104	31°12'24"	148°11'12"			
	4105	31°00'06"	148°17'18"			
	4106	30°42'30"	148°42'50"			
	4107	31°18'15"	149°01'09"			
	4108	31°18'54"	148°40'53"	X		
	4113	33°48'	146°01'	X		
	4126	34°50'	143°33'	X		
Western Australia	4400	33°10'30"	118°11'50"	X		
	4401	33°56'35"	118°12'50"	X		
	4402	34°10'35"	118°56'29"			
	4403	33°45'04"	116°59'45"			
	4404	32°58'12"	119°23'42"			
	4405	33°00'36"	118°34'00"	X		
	4406	33°40'18"	118°27'01"	X		
	4407	32°10'06"	116°53'30"	X		
	4408	31°49'39"	118°03'40"	X		
	4409	32°14'00"	118°03'38"	X		
	4410	31°28'35"	117°21'45"			
	4411	30°57'36"	117°00'24"			
	4412	31°23'45"	117°49'27"	X		
	4413	32°35'39"	119°15'31"			
	4414	30°26'30"	117°34'45"			
	4415	32°46'00"	118°33'18"	X		
	4416	31°33'45"	118°03'51"	X		
	4417	30°17'18"	117°57'00"			
	4418	30°42'00"	117°49'00"	X		
	4419	30°28'00"	118°23'48"			
	4420	32°08'00"	119°00'48"			
	4421	32°35'47"	117°28'47"			
	4422	32°10'27"	117°21'48"			
	4423	30°32'06"	118°38'03"			
	4424	28°32'30"	115°03'15"	X		
	4425	30°07'30"	115°29'48"			
	4426	30°17'36"	117°12'48"			
	4427	30°23'15"	116°45'51"	X		
	4428	30°27'00"	115°08'45"			
	4429	30°43'00"	115°56'30"			
	4430	29°02'37"	116°11'48"	X		
	4431	28°48'17"	115°43'32"			

TABLE 4.- Concluded.

STATE	SEGMENT	LATITUDE, S.	LONGITUDE, E.	INDICATOR REGION SITE	79-80 GROUND TRUTH	POSSIBLE 80-81 GROUND TRUTH
Western Australia	4432	28°38'43"	115°23'41"	X		
	4434	28°16'27"	114°42'45"			
	4435	29°16'42"	116°25'39"			
	4436	29°43'36"	116°26'00"	X		
	4437	29°31'45"	115°44'42"			
	4438	30°57'06"	116°04'38"			
	4439	30°48'09"	116°31'51"	X		
	4446	33°48'00"	119°32'00"			
	4448	30°56'48"	119°20'51"			
	4449	31°32'21"	119°07'51"	X		
	4450	31°12'40"	119°28'54"			
New South Wales	4500	31°12'30"	149°55'00"			
	4501	31°20'00"	150°27'30"			X
	4502	31°25'00"	150°25'00"			X
	4503	31°27'30"	150°05'00"			X
	4504	31°20'00"	150°10'00"			X
	4505	31°05'00"	150°25'00"			X
	4506	31°12'30"	150°50'00"			X
	4507	31°10'00"	150°05'00"			X
	4508	31°20'00"	149°35'00"			X
	4509	31°25'00"	150°32'00"			X
	4510	31°20'00"	149°55'00"			X
	4511	31°10'00"	150°25'00"			X
	4512	31°35'00"	150°20'00"			X
	4513	30°05'00"	149°10'00"			X
	4514	29°55'00"	149°55'00"			X
	4515	30°10'00"	149°50'00"			X
	4516	29°57'30"	149°22'30"			X
	4517	29°50'00"	149°20'00"			X
	4518	29°47'30"	149°05'00"			X
	4519	30°05'00"	148°55'00"			X
	4520	30°12'30"	149°37'30"	X		X
	4521	30°05'00"	149°50'00"			X
	4522	29°48'45"	149°55'00"			X
	4523	29°47'30"	140°35'00"			X
	4524	29°55'00"	149°05'00"			X
	4525	30°20'00"	149°40'00"			X
	4526	30°02'30"	149°40'00"			X
	4527	33°40'	146°56'	X		
	4528	33°37'	147°54'	X		
	4529	34°34'	147°33'	X		
	4530	34°16'	147°18'	X		
Western Australia	4531	30°46'	118°22'	X		
	4532	33°04'	121°46'	X		
	4533	33°13'	117°21'	X		
	4534	33°05'	117°21'	X		
	4535	32°44'	117°42'	X		
	4536	31°49'	117°00'	X		

size allocation on three crops was performed. The probability of a segment being allocated to a shire would be proportional to the shire's planted acreage for each crop.

The outcome was an allocation of 53 segments such that these conditions were represented: 60% were in high wheat shires, 40% low wheat, 60% high barley, 40% low barley, 60% high oats, and 40% low oats (Table 5).

After the allocated segment locations were determined, if there was an existing segment in a shire from the original allocation (in 1976) with 20% or more agricultural area, this segment was used. If there was more than one such segment, the one with the "best" acquisition history was chosen. Preference was given to ground truth sites that fit this criterion. New sites were allocated randomly within the shires with the requirement that the segment contain at least 20% agricultural area.

The 147 segments are to support the Exploratory Experiment. Since the Pilot requires aggregatable segments, a new allocation would be needed to support an aggregation. This will be done after the sample frame data set is provided by USDA in FY1982, the coefficient of variation is determined, high density tapes are acquired, and the methodology of extracting segment data off the high density tapes is developed.

Table 6 provides a summary of Landsat segment data.

TABLE 5.- INDICATOR REGION SITES (SPECIAL SUBSET)

State	Shire	Shire code	Segment number	Acreage W/B/O	Comments
NSW	Lachlan	164	4049	HHH	Old LACIE site
	Bland*	166	4527	HHH	New site
	Carrathool	204	4133	HHH	Old LACIE site
	Goobang	163	4048	HHH	Old LACIE site, 1980-81
	Narrandera	202	4070	HHH	Old LACIE site
	Coolamon	201	4055	HHH	Old LACIE, also 1980-81
	Namoi	125	4095	HHL	Old LACIE, also 1980-81
	Namoi	125	4520	HHL	1980 site
	Liverpool Plains	115	4015	HHL	Old LACIE site, GT available, 1980-81
	Liverpool Plains	115	4016	HHL	Old LACIE site, 1980-81 GT
	Liverpool Plains	115	4013	HHL	Old LACIE, 1980-81
	Coonabarabran	127	4033	LLL	Old LACIE site, 1980-81 GT
	Jemalong*	160	4528	HHL	New site
	Timbrebongie	135	4042	HLH	Old LACIE site, GT 2 years, 1980-81
	Timbrebongie	135	4043	HLH	Old LACIE site, 1980-81
	Coonamble	138	4108	HLH	Old LACIE site, 1980-81
	Gilgandra	128	4038	HLH	Old LACIE site, 1980-81
	Boolooroo	122	4082	HLL	Old LACIE site also, 1980-81
	Yallaroi	109	4022	HLL	Old LACIE site
	Lockhart	203	4064	LHH	Old LACIE site, 1980-81

*New site

TABLE 5.- Continued

State	Shire	Shire code	Segment number	Acreage W/B/O	Comments
NSW	Lockhart	203	4065	LHH	Old LACIE site, 1980-81
	Narrabura*	190	4529	LHH	New site
	Narrabura*	190	4530	LHH	New site
	Corowa	214	4073	LHL	Old LACIE site
	Wakool	222	4126	LHL	Old LACIE site
	Mitchell	200	4066	LLH	Old LACIE site, 1980-81
	Weddin	159	4053	LLH	Old LACIE site, 1980-81
	Coonabarabran	127	4030	LLL	Old LACIE site, 1980-81 GT
WA	Lake Grace	79	4405	HHH	Old LACIE site, 1980-81
	Mount Marshall	103	4418	HHH	Old LACIE site, 1980-81
	Gnowangerup	76	4401	HHH	Old LACIE site, 1980-81
	Narembeen	1105	4420	HHH	Old LACIE site, 1980-81
	Kulin	101	4415	HHH	Old LACIE site, 1980-81
	Corrigin	93	4409	HHH	Old LACIE site, 1980-81
	Mullewa	143	4432	HHL	Old LACIE site, 1980-81
	Kent	80	4406	HHL	Old LACIE site, 1980-81
	Morawa	142	4430	HHL	Old LACIE site, 1980-81
	Bruce Rock	92	4408	HHL	Old LACIE site, 1980-81
	Yilgarn	169	4449	HLH	Old LACIE site, 1980-81
	Dalwallina	134	4427	HLH	Old LACIE site, 1980-81

*New site

TABLE 5.- Concluded

State	Shire	Shire code	Segment number	Acreage W/B/O	Comments
WA	Perenjori	145	4436	HLH	Old LACIE site, 1980-81
	Mukinbudin*	104	4531	HLH	New site
	Wongan Ballida	148	4439	HLL	Old LACIE site, 1980-81
	Merredin	102	4416	HLL	Old LACIE site, 1980-81
	Esperance*	163	4532	LHH	New site
	Beverley	90	4407	LHH	Old LACIE site, 1980-81
	Dumbleyung	75	4400	LHL	Old LACIE site, 1980-81
	Chapman Valley	131	4424	LHL	Old LACIE site, 1980-81
	Wagin*	83	4533	LHH	New site
	Narrogin*	107	4534	LHH	New site
	Wickepin	118	4535	LLH	New site
	York*	121	4536	LLH	New site
	Kellerberrin	98	4412	LLL	Old LACIE site, 1980-81

*New site

TABLE 6.- SUMMARY OF LANDSAT SEGMENT DATA

Crop year	State	Number of segments allocated	Number of segments received (as of 4/81)	Average* number of acquisitions received per/ segment received
1975-1976	New South Wales	Exploratory sites	4	4.25
	Queensland		2	3.50
	South Australia		2	2.50
	Victoria		2	5.50
	Western Australia		4	2.50
Total	5 States		14	
1977-1978	New South Wales	125	125	7.42
	Queensland	16	16	7.88
	South Australia	23	23	2.74
	Victoria	44	44	5.41
	Western Australia	49	49	6.16
Total	5 States	257	257	
1978-1979	No data collected			
1979-1980	New South Wales	125	125	9.61
	Queensland	16	16	10.81
	South Australia	23	23	3.43
	Victoria	44	44	5.09
	Western Australia	49	49	6.37
Total	5 States	257	257	
1980-1981	New South Wales	88	87	5.41
	Western Australia	43	42	3.24
Total	2 States	131	129	
1981-1982	New South Wales	98	Not available at this time	
	Western Australia	49		
Total	2 States	147		

*does not reflect the typical segment

4.4 GROUND OBSERVATIONS IN AUSTRALIA (TABLE 7)

During LACIE Transition-Year processing (1977-78 crop year) of Australia, it was determined that an agricultural experiment farm was within sample segment 4042. This prompted project personnel to initiate the action to establish a liaison with Australian agronomists for collecting these ground truth data.

Ground truth data for sample segment 4042, Timbrebongie Shire, New South Wales, Australia, were collected for crop year 1977-78. The data were collected by Ken W. Dawbin, Remote Sensing Officer (Research and Interpretation), Department of Agriculture, New South Wales, Australia. He provided detailed sketches of the fields within the sample segment.

Extensive use of these ground observations was made in identifying technical issues to be addressed prior to processing Australian data during the Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing (AgRISTARS) program. A summarization and consolidation of various Australian special studies and investigations that have been conducted upon completion of LACIE is contained in:

> Payne, R. W.; Armstrong, T. C.: Australian Transition Year Special Studies, FCPF AgRISTARS, JSC-16368, January 1981.

Ground data were obtained for six sites in New South Wales in the 1979-80 crop season. These are being processed for use in the AgRISTARS program. Twenty-seven segment locations over ground observation points provided by the Australians were located for data collection in the 1980-81 crop season. However, these ground observations have not been obtained from the Australians at this time.

Ground observations in Western Australia for crop year 1980-81 were collected by Bill Dowdy (USDA), Don Henninger (NASA), and Dave Nichols (LEMSCO) in late October and early November 1980. These observations were collected over fields along major roads in a subset of seven Western Australia sample segments.

TABLE 7.- GROUND OBSERVATIONS, AUSTRALIA

1977-78	1979-80	1980-81
4042 Timbrebongie Shire, New South Wales, Australia	4013 New South Wales 4015 New South Wales 4016 New South Wales 4030 New South Wales 4033 New South Wales 4042 New South Wales 4500 New South Wales* to 4526 New South Wales	4408 Western Australia 4412 Western Australia 4416 Western Australia 4419 Western Australia 4423 Western Australia 4425 Western Australia 4427 Western Australia

*To date, no ground-observed data has been received.

4.5 GENERAL AUSTRALIAN 1980-81 CROP YEAR GRAIN SITUATION (AS OF DECEMBER 1980)

- Only in Victoria, South Australia, and southern New South Wales will average or better yields be obtained.
- Stripe rust is again (first noticed 1979) reducing yields seriously in the northern Wimmera area of Victoria.
- Near records sown but Australian winter cereal production down almost 30% from 20.8M tonnes in 1979 to 14.8M tonnes in 1980.
- Wheat production down over 30% to 10.6M tonnes.
- Production of prime hard wheat (northern New South Wales, Queensland) at less than 200,000 tonnes compared to an average of 800,000 tonnes over the last five years (down 75%).
- Production of barley and oats is less affected with over half the crop sown in the more favored regions of Victoria and South Australia.
- In New South Wales, very dry early conditions will substantially reduce the state's overall winter cereal and oilseeds production.
- While New South Wales area sown to winter cereals was the second largest on record after 1968-69, over 20% of the crop is estimated to have been abandoned due to drought.
- Forty-six out of 58 New South Wales pasture protection board areas are either wholly or partly drought declared.
- Victoria expects above average yields for all crops for the third season in a row, though in the northern Mallee areas crops have been adversely affected by dry conditions.
- Conditions in South Australia have been very favorable for all but the early-sown winter cereal and oilseeds crops. Cereal production because of increased sowings expected third largest on record.
- Western Australia had dry conditions throughout the state. By mid-November, thirty shires were declared fully or partly drought stricken.
- Western Australia wheat yields have been lower only once in the past 30 years (1969-70).
- Western Australia oats and barley yields are less seriously affected; they are traditionally grown in the higher rainfall areas.

4.5.1 1980-81 CROP YEAR GRAIN PRODUCTION - NEW SOUTH WALES (AS OF DECEMBER 1980)

Planting Times - 1980 Season

Wheat - April to August, with two-thirds complete in June, north of Dubbo and 90% complete south of Dubbo.

Barley - May to August, main barley sowings were complete in July; small areas in the north were still to be planted at that time.

Oats - March to July, early-sown oats were used as grazing in May; not all intended grazing plantings were made. Proportion planted for grain higher than last year. Sowings finished in July with an estimated hectarage over 500,000. (600,000 estimate in September).

Estimated Losses

Wheat - 3,300,000 hectares sown. Expected harvested area only 2,500,000 hectares (24% loss). Production estimated at 2,800,000 tonnes, compared to 1979's 5,900,000 tonnes (down 53% in New South Wales) (Australia country production estimated down 30%).

Barley - Predictions of output have continued to fall. Barley production will probably finish below 500,000 tonnes compared with last year's 680,000 tonnes (down 26% in New South Wales).

Oats - Predictions of output have continued to fall. Oats production will probably finish at 300,000 tonnes, compared with last season's 463,000 tonnes (down 35% in New South Wales).

5. CONTACTS BETWEEN LACIE/AgRISTARS AND AUSTRALIA

Interactions between LACIE/AgRISTARS and Australian personnel have been taking place since approximately 1975. Results of these contacts have been invaluable to the AgRISTARS Foreign Commodity Production Forecasting Project (FCPF). Information about these contacts pertinent to the project are not included in this document in order to avoid contact through inappropriate channels. Project personnel requiring contact with Australian personnel should contact the FCPF Project Manager.

APPENDIX A

AUSTRALIA - GOVERNMENT ORGANIZATION

AUSTRALIA - GOVERNMENT ORGANIZATION

The chief exective officer of the federal government is the Prime Minister (Figure A-1, Box 4). The prime minister works with the Cabinet; the function of which is formal in character and advisory. The Cabinet (Figure A-1, Box 5) consists of fourteen senior ministers holding the more important portfolios. Chaired by the prime minister, the Cabinet serves as the highest decisionmaking body in terms of executive and legislative initiatives and actions and meets informally to deliberate the issues of the day.

The Federal Executive Council (Figure A-1, Box 3) is composed of all the ministers of the day; it is presided over by the governor general. The council attends to matters requiring the formality of confirmation or of ratification. It lends legality to the decisions of the Cabinet on major national issues and also gives formal approval on such matters as Cabinet appointments and proclamations of law.

At present (May 1981) there are twenty-six departments under the charge of ministers of state. The ministers of fourteen of these departments hold Cabinet rank; the twelve other departments have ministers that do not hold Cabinet rank (Figure A-1, Box 6).

The 14 Departments within the Cabinet
(Source: Australian Embassy, 1981)

1. Trade and Resources
2. Industry and Commerce
3. Communications
4. National Development and Energy
5. Foreign Affairs
6. Primary Industry
7. Treasury
8. Industrial Relations

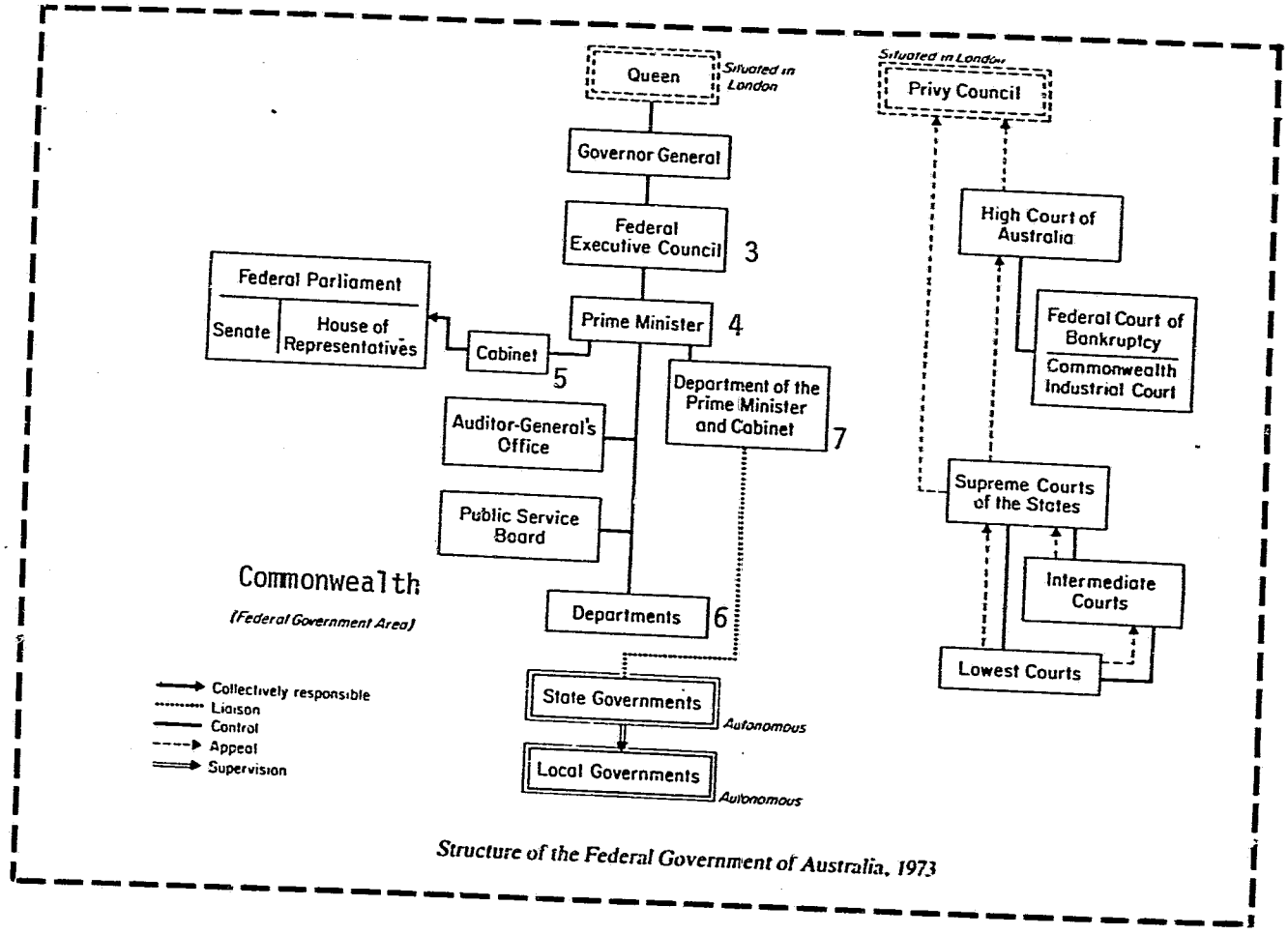


Figure A-1.- Structure of the federal government of Australia, 1973.
(Source: Area Handbook for Australia, 1974.)

9. Defense
10. Finance
11. Employment and Youth Affairs
12. Attorney General
13. Social Security
14. Science

The 12 Departments without Cabinet Rank

1. Home Affairs and Environment
2. Transport
3. Health
4. Education
5. Immigration and Ethnic Affairs
6. Science and Technology
7. Administrative Services
8. Business and Consumer Affairs
9. Capital Territory
10. Veterans Affairs
11. Aboriginal Affairs
12. Housing and Construction

The activities of the various departments are coordinated and supervised by the Department of the Prime Minister and Cabinet (also Prime Minister's Department (Figure A-1, Box 7), which serves as the chief of staff and nerve center of the executive government.

Ministerial departments, in turn, supervise the operation of a number of statutory corporations, such as the Commonwealth Scientific and Industrial Research Organization (CSIRO), (Figure A-2, Box 8) the Australian Atomic Energy Commission, the Australian Broadcasting Commission, and the Australian Ship-loading Board, to name only a few.

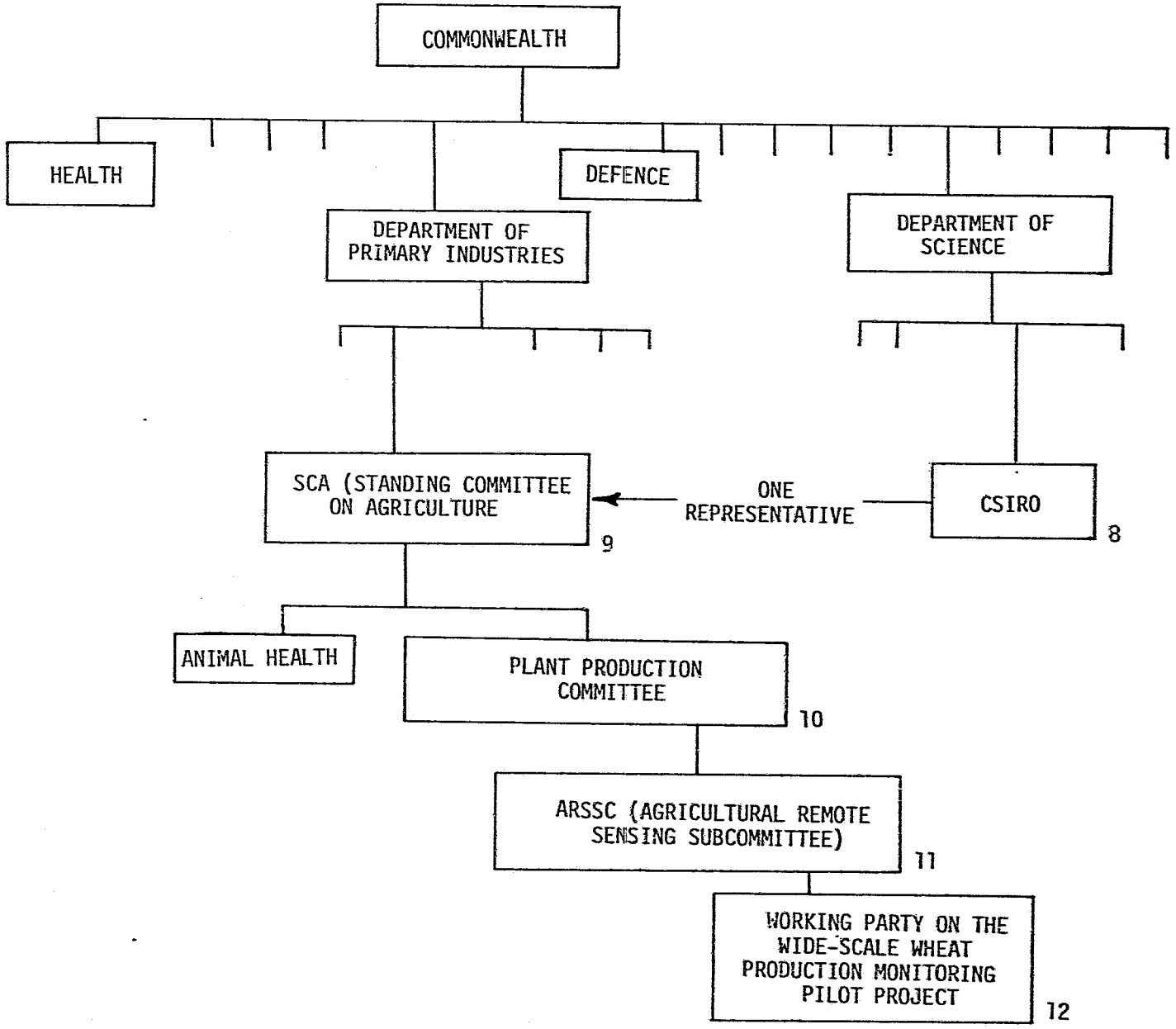


Figure A-2.- Relationships of the Working Party (Box 12) in the Government of Australia.

The following was taken from Australia Handbook 1975. See figure A-2, Box 8, for the relationship of CSIRO to the Working Party.

"The Commonwealth Scientific and Industrial Research Organization is Australia's largest scientific research organization. A statutory body, it was created in 1949 to replace the former Council for Scientific and Industrial Research established in 1926. CSIRO does scientific research for primary and secondary industries in Australia and its territories, trains scientific research workers and awards studentships, makes grants to aid scientific research, supports research associations, maintains federal standards of measurement, disseminates scientific and technical information and publishes scientific and technical reports. It does not engage in defence or atomic energy research and has made only limited use of research workers in the social sciences. It has recently entered the field of human nutrition.

CSIRO is governed by an executive of five full-time and four part-time members, most of whom are scientists. The executive is responsible to the Minister for Science. In August 1974, CSIRO had 36 research divisions and four smaller research units, a number linked in laboratory groups. The divisions are animal genetics, animal health, animal physiology, applied chemistry, applied geomechanics, applied physics, atmospheric physics, building research, chemical engineering, chemical physics, cloud physics, computing research, entomology, environmental mechanics, fisheries, oceanography, horticultural research, irrigation research, land resources management, land use research, mathematical statistics, mechanical engineering, mineral chemistry, mineral physics, mineralogy, nutritional biochemistry, physics, plant industry, protein chemistry, radiophysics, soils, textile industry, textile physics, tribophysics, tropical agronomy and wildlife research. The units deal with agro-industrial research, marine biochemistry,

solar energy studies and wheat research. CSIRO has more than 100 laboratories and field stations throughout Australia with a staff of about 6,600. About a third are professional scientists.

In 1973-74, CSIRO operations cost about $86 million, more than 80 percent of which was met by the Australian Government through direct appropriation. Of the remaining 20 percent, about four-fifths was concerned with research for various primary industries and came from statutory trust funds derived from levies on primary produce and a supplementary contribution by the Australian Government. The balance of operating expenses came from individual companies, other Australian Government agencies, overseas instrumentalities and private foundations.

CSIRO's head office is in Canberra; regional administrative offices are in Canberra, Brisbane, Sydney and Melbourne. CSIRO provides staff for Australian scientific liaison offices in London, Washington, and Tokyo."

The Standing Committee on Agriculture (SCA) (Figure A-2, Box 9) is a technical body comprised of the states' permanent heads of the agriculture departments and the Department of Primary Industry (DPI) agriculture department head (Figure A-2). The SCA functions within the administrative realm of the Commonwealth Department of Primary Industry. Under the SCA are several other committees; one of which is the Plant Production Committee (Figure A-2, Box 10) and under it is the Agricultural Remote Sensing Sub-Committee (ARSSC) (Figure A-2, Box 11). Under the ARSSC is the Working Party on the Wide Scale Wheat Production Monitoring Pilot Project (Figure A-2, Box 12). This Working Party is a small group of four or five people located in different states which directly oversee the Wide Scale Wheat Production Monitoring Pilot Project.

The Wide Scale Wheat Production Monitoring Pilot Project is being conducted by the New South Wales Department of Agriculture assisted by IBM and is very small (probably a maximum of three man-equivalents of effort). The SCA and the ARSSC function as a coordinator of activities involving several states rather than providing direction. The Working Party in turn functions as a coordinator for and advisor to the Wide Scale Wheat Production Monitoring Pilot Project.

NEW SOUTH WALES DEPARTMENT OF AGRICULTURE

(Source: Official Year Book, New South Wales No. 65, 1979)

The New South Wales Department of Agriculture is the State authority responsible for agricultural industries in general. The Department administers policy and Acts of Parliament relating to agriculture and seeks, by scientific investigation and experiment and the dissemination of information, to promote improved methods of cultivation, new crops, pest control, the use of fertilizers, irrigation, and better marketing of produce. It conducts the Orange, Yanco, and C. B. Alexander Agricultural Colleges.

The New South Wales Department of Agriculture includes the following divisions: [Figures A-3 (Box 14) and A-4]

Plant Industry. Research and extension work in connection with field crops, pastures, weeds, fodder conservation, irrigation, and cloudseeding; seed testing certification; and prickly pear control.

Horticulture. Research and extension work in connection with fruit culture and viticulture, and vegetables; administration of Acts relating to pest and disease control and marketing of fruit; licensing of potato growers, nurserymen, and resellers of nursery stock; export of agricultural commodities; plant quarantine.

Animal Industry. Investigation and control of animal diseases (including cattle tick); veterinary research; livestock production research, and extension services relating to sheep, wool, beef cattle, horses, goats, pigs, poultry, and bees; meat inspection; drought relief; registration of brands; noxious animals and insects.

Dairying. Herd improvement through herd recording, nutrition, breeding, and general dairy stock management; extension work in connection with the quality (both on farms and in manufacturing establishments) of dairy products; administration of Acts relating to dairy produce manufacture; research and extension work in connection with new dairy foods, mastitis control, milking shed management.

MINISTRIES OF NEW SOUTH WALES SINCE 1962

Number	Name of Premier and Party	From-	To-
60	Heffron (Labor)	14 Mar. 1962	30 Apr. 1964
61	Renshaw (Labor)	30 Apr. 1964	13 May 1965
62	Askin (Lib.-C.P.)	13 May 1965	5 Mar. 1968
63	Askin (Lib.-C.P.)	5 Mar. 1968	11 Feb. 1969
64	Askin (Lib.-C.P.)	11 Feb. 1969	11 Mar. 1971
65	Askin (Lib.-C.P.)	11 Mar. 1971	19 June 1972
66	Askin (Lib.-C.P.)	19 June 1972	17 Jan. 1973
67	Askin (Lib.-C.P.)	17 Jan. 1973	3 Dec. 1973
68	Askin (Lib.-C.P.)	3 Dec. 1973	3 Jan. 1975
69	Lewis (Lib.-C.P.)	3 Jan. 1975	23 Jan. 1976
70	Willis (Lib.-C.P.)	23 Jan 1976	14 May 1976
71	Wran (Labor)	14 May 1976	In Office

The Ministry in office in May 1978 consisted of the following eighteen members: —

Premier. — The Hon. N. K. Wran, Q.C., M.P.

Deputy Premier, Minister for Public Works, and Minister for Ports. — The Hon. L. J. Ferguson, M.P.

Treasurer. — The Hon. J. B. Renshaw, M.P.

Minister for Transport and Minister for Highways. — The Hon. P. F. Cox, M.P.

Attorney-General. — The Hon. F. J. Walker, LL.M., M.P.

Minister for Industrial Relations, Minister for Mines, and Minister for Energy. — The Hon. P. D. Hills, M.P.

Minister for Planning and Environment and Vice-President of the Executive Council. — The Hon. D. P. Landa, LL.B., M.L.C.

Minister for Decentralisation and Development and Minister for Primary Industries. — The Hon. D. Day, M.P. [1]

Minister for Education. — The Hon. E. L. Bedford, B.A., M.P.

Minister for Local Government. — The Hon. H. F. Jensen, M.P.

Minister for Lands. — The Hon. W. F. Crabtree, M.P.

Minister for Health. — The Hon. K. J. Stewart, M.P.

Minister for Consumer Affairs and Minister for Co-operative Societies. — The Hon. S. D. Einfeld, M.P.

Minister of Justice and Minister for Housing. — The Hon. R. J. Mulock, LL.B., M.P.

Minister for Sport and Recreation and Minister for Tourism. — The Hon. K. G. Booth, M.P.

Minister for Conservation and Minister for Water Resources. — The Hon. A. R. L. Gordon, M.P.

Minister for Youth and Community Services. — The Hon. R. F. Jackson, M.P.

Minister for Services and Minister Assisting the Premier. — The Hon. W. H. Haigh, M.P.

(Fig. A-4, Box 13)

1. New Named Department of Agriculture.

Figure A-3.- Ministries of New South Wales. (Source: Official Year Book, New South Wales, No. 65, 1979.)

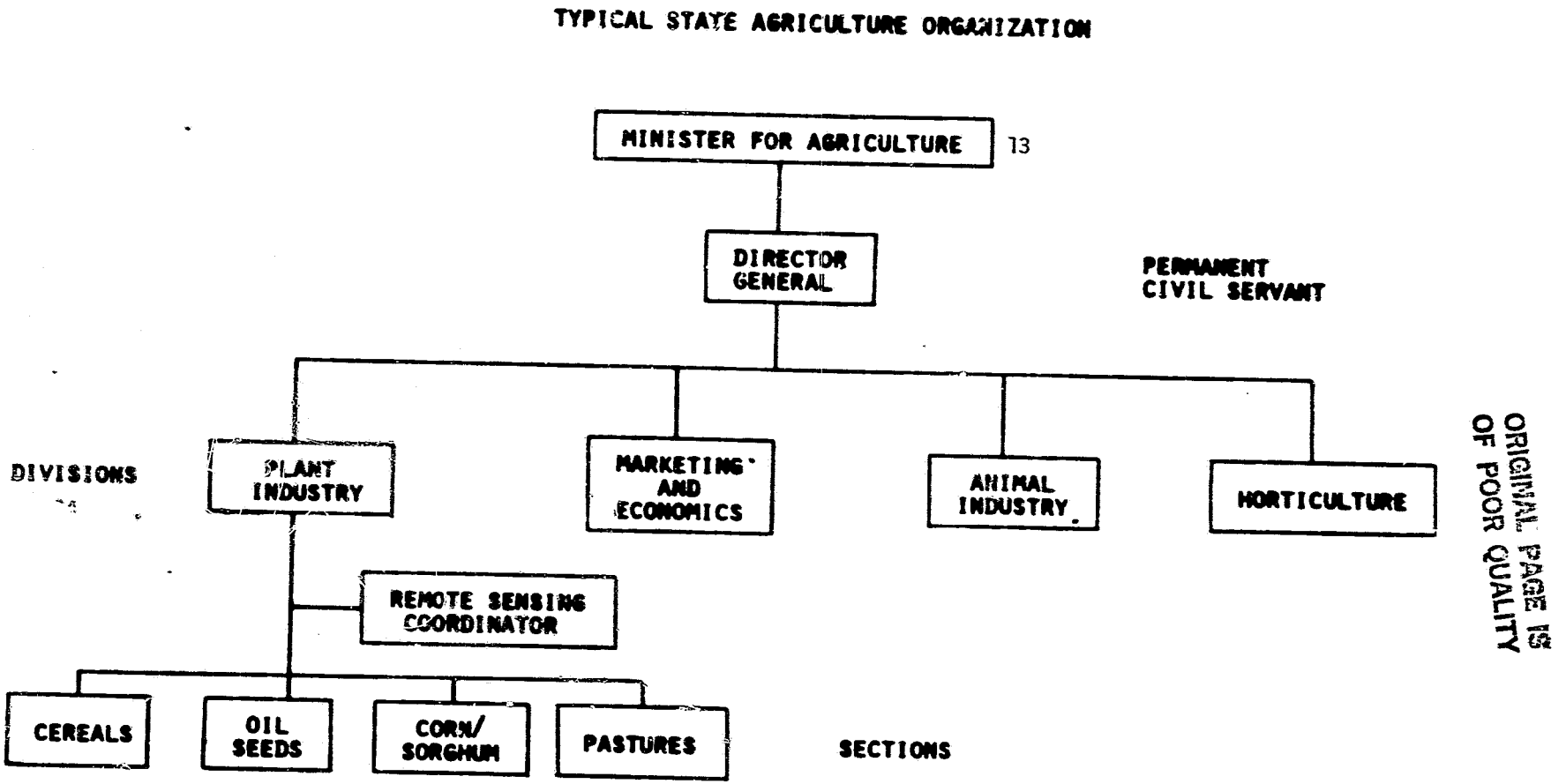


Figure A-4.- Typical state agriculture organization.

Biological and Chemical Research. Agricultural biology (plant pathology and bacteriology) and chemistry, and entomology.

Marketing and Economics. Administration of Marketing of Primary Products Act; collection and dissemination of general information relating to production and marketing of agricultural products; reporting of livestock and farm produce markets; issue of crop reviews and forecasts; research and extension work in connection with agricultural economics, farm management, and marketing.

Extension Services. Administration and coordination of regional extension and regional publicity; agricultural groups (Agricultural Bureau and Rural Youth Organization); editing and distribution of publications, film library, radio, television, photographic, and display services.

Research Services. Direction and control of Regional Research Centers and associated Research Stations and their research programs; operation of an Agricultural Engineering Center and an Agricultural Mechanization Extension Service; the supervision of the capital works program for departmental institutions; administration of research grants.

Soil conservation, water conservation and irrigation, and forestry are the responsibility of three organizations--the Soil Conservation Service, the Water Resources Commission, and the Forestry Commission.

The relevant legal powers in regard to agriculture are essentially vested in the states, whereas the financial resources are predominantly under the control of the federal government. The provisions of the constitution, particularly those that assign development essentially to the states and interstate and foreign trade and commerce to the federal government, have required correlation for effective action. A decision by a state, for example, to promote the development

a forest or of an area that can be made fertile by irrigation may be simply impossible to effect without the support of federal agencies. In fact, so long as the constitutional framework remained as it was in late 1973, the effective development of the country's agricultural sector (including fisheries and forestry) would require action at every level of government--federal, state, and local.

Federal-state consultation relating to agriculture took place through several institutional channels. At the federal-state ministerial level, for example, the appropriate federal and state ministers constituted the Australian Agricultural Council, the Australian Forestry Council, the Australian Fisheries Council, and the Australian Water Resources Council. These bodies particularly promoted common or coordinated action in the northern part of the country.

The meetings of ministers in these councils were in most cases supported by standing or ad hoc committees of senior departmental officers. Federal-state cooperation in the development of agriculture (including fisheries and forestry) occurred through a number of institutions, including such instrumentalities of the federal government as the Bureau of Agricultural Economics and the Forest Research Institute in the Department of of Primary Industry and the Commonwealth Scientific and Industrial Research Organization (CSIRO).

The six state governments were responsible for such matters as land tenure and land settlement policy, internal quarantine, intrastate trade, advisory and extension services, agricultural education, and much of the agricultural research, particularly for application at the farm level. The federal government had full responsibility for agriculture in the Northern Territory and the Australian Capital Territory, for financial assistance to all farmers in income tax concessions, for most overseas marketing and quarantine services, for export inspection, and for a wide range of research, particularly, economic research.

The federal government also played a coordinating role in many matters where interstate cooperation was required. Policy matters affecting the federal government and one or more states were discussed by the Australian Agricultural Council, composed of the state ministers of agriculture and the federal minister for primary industry (in 1973 the department responsible for agriculture, forestry, and fisheries was called the Department of Primary Industry; these responsibilities in the federal territories were administered by the Department of the Capital Territory and by the Department of Northern Development). The council approved subsidies, price stabilization, and other organized marketing programs subject to government legislation. Its policies were usually made effective by complementary federal and state action.

Federal government direct support of the agricultural sector was by the early 1970s costing over A$400 million annually. Governmental support has included drought assistance, flood assistance, tax concessions, low interest rates on loans for the agricultural sector, commodity price stabilization plans, subsidies for specialized crops, and other financial support when the sector was disadvantaged by changes in currency exchange rates, market changes, or altered consumer requirements.

The Australian Labor Party (ALP) government has taken some steps to reduce financial support from federal government sources. The treasurer announced in his 1973/74 budget speech that the government had decided to phase out the bounties on butter and cheese production over fiscal years 1973/74 and 1974/75 and that the bounty on processed milk products, the rate of which was tied to the butter and cheese bounty, should be phased out simultaneously.

The budget speech also announced the removal of some important tax concessions, such as full deduction of the total cost of land clearing, soil reclamation, fencing to combat animal pests, and soil erosion in the year in

which the expenditure occurred. Until 1973 the depreciation allowances had permitted farmers to write off over five years the cost of most machinery, equipment, and structures, including housing for employees up to a limit of A$6,500 per worker. In addition, farmers had been granted an investment allowance of 20 percent on the initial purchase of new machinery and equipment other than road vehicles.

The treasurer announced in the budget speech that the investment allowance would not apply to expenditure incurred after August 24, 1973, except where it was incurred under a contract already entered into before that date. The deductions for capital expenditures were withdrawn, unless made under a contract already in force. Average depreciation rates were to be allowed, generally over a five- to ten-year period, on expenditures for machinery and structure, and over a ten-year period for other items.

APPENDIX B

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BIBLIOGRAPHY

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